American Machinist

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Westinghouse Brief for the American Machinist Awards for 1931

No disparagement of other briefs can be implied in the statement that the brief of the East Pittsburgh Works of Westinghouse Electric & Mfg. Company is the most striking of the eight finalists. The figures involved are bound to fire the imagination of anyone not connected with an enterprise of equal size. The investment in machine tool equipment in that one plant, for instance, totals 10,500,000 dollars; investment in motors to run the equipment 1,500,000 dollars.

It is no less than fair to say that the author, J. C. Weaver, superintendent, manufacturing equipment department, is a pioneer in developing policies for equipment replacement. His writings on the subject will be remembered by readers of *American Machinist* with pleasure.

During the fall of 1927, his company surveyed all manufacturing equipment. This survey brought out astonishing, and some amusing facts—114 tools, for example, were not being used at all. Others should have been retired long ago.

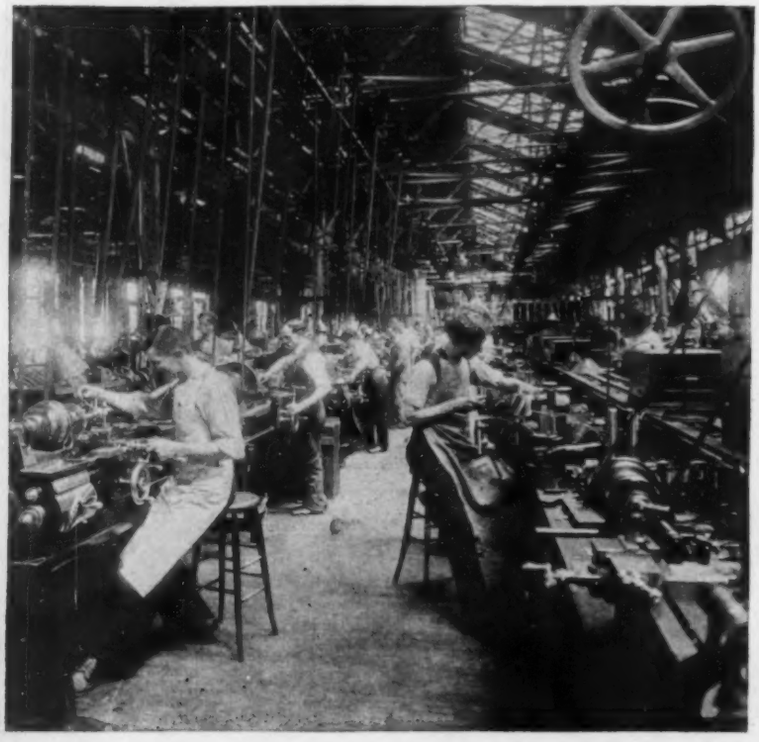
Although he does not enlarge upon it in this brief, Mr. Weaver took his facts to the board of directors and sold its members in a consistent replacement policy which would replace 500,000 dollars' worth of tools each year for five years. The principles underlying the policy and the results achieved are all described in the pages immediately following.

The results more than justify the original estimates. Instead of projected savings of 370,623 dollars, the actual figures for the three years in which the policy has been in effect show 471,621 dollars. Workmen are better satisfied; works delivery costs have been reduced 4 per cent; 75 per cent of the equipment is now less than 10 years old. With a definite plan for definite replacement, appropriations have been better spent. Both Westinghouse and Mr. Weaver are to be congratulated.

The lathe group in Department F, 18 years ago, with machines lineshaft driven, insufficient lighting and only average working conditions

Progressive Replacement At Half a Million a Year

J. R. WEAVER
Superintendent, Manufacturing Equipment Department, Westinghouse Electric & Mfg. Company



Four years ago, Westinghouse made a survey of the $10,500,000 worth of machine tools and the $1,500,000 worth of motors at the East Pittsburgh Works, which produced something over $50,000,000 worth of products each year. The survey showed that tools valued at $2,500,000 should be replaced during the following five years, that 114 tools were but taking up floor space, that a simple formula would help to point the way. In three years replacement has saved $471,621, has bettered product, improved working conditions, and speeded production*

*Brief entered for the *American Machinist* Award for 1931, Class I. Recommended by the Committee on Awards for special consideration and publication

The lathe group in Department F as it is today. Machines are individually motor driven, lighting has been brought up to 1931 standards

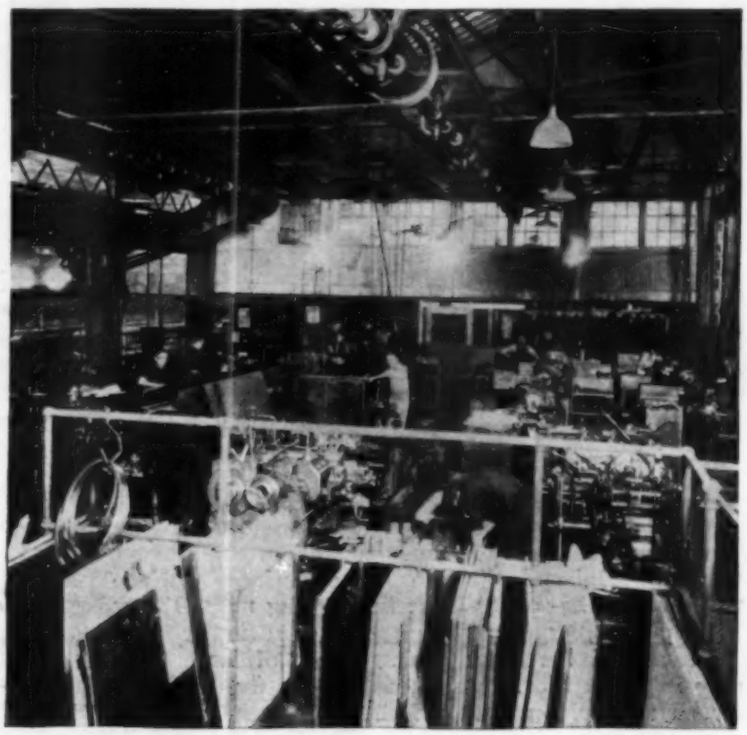
DURING the fall of 1927 and the spring of 1928, a complete survey was made of the manufacturing equipment at the East Pittsburgh Works of the Westinghouse Electric and Manufacturing Company to obtain information on the status of the equipment in use. It resulted in the replacement policy described in this paper. The East Pittsburgh Works is a large plant, doing a business in excess of $50,000,000 per year during the exceedingly variable years of 1928, 1929, and 1930.

At this Works are manufactured a variety of products, consisting mainly of industrial motors and controls, railway motors and controls, the electrical portion of power house units, switchgear apparatus, and Micarta products. To manufacture these products, it is necessary to provide equipment of a variety of sizes and types. However, the majority is standard general-purpose equipment; special high-production equipment is used only on those operations where the quantity produced justifies the installation.

The investment in machine tools at the East Pittsburgh Works is approximately $10,500,000; the investment in motors to run this equipment is $1,500,000. The equipment may be divided into these groups according to age:

$5,000,000 invested in equipment
up to 5 years old
$2,400,000 invested in equipment
from 5 to 10 years old
$2,000,000 invested in equipment
from 10 to 15 years old
$600,000 invested in equipment
from 15 to 20 years old
$500,000 invested in equipment
more than 20 years old

It must be realized that the Company has a great deal of extremely large equipment, the design of which has not been appreciably changed and that, therefore, its



Another pair of comparative photographs of the lathe group then (left) and now, showing again the bettered working conditions

Manufacturing details for control apparatus in 1928, and the same department today, a comparison worth studying

replacement is not justified on a cost-reduction basis. This equipment is slow-moving and will practically never wear out if given ordinary care. It includes machine tools such as 25- or 30-ft. vertical boring mills, 12- or 14-ft. planers, large hydraulic presses, and similar units.

Because of the considerable number of large tools, only 75 per cent of the equipment is less than 10 years old. However, a modern shop has been maintained and the equipment kept at maximum efficiency.

During the years mentioned above, the various departments were in full operation, and it is estimated that the over-all of the equipment in operation was about 90 per cent.

A careful record is kept of all equipment purchased and installed, and this equipment is allocated to the various departments in which it is used. The rate of depreciation is 5 per cent. This depreciation is charged into the expense statements for each department each month. In this way, the cost of the product absorbs the cost of depreciation on the machine tools. If there is a balance yet to be depreciated when the tool is removed from a department and scrapped or otherwise disposed of, this balance is deducted from the depreciation reserve set up on the books. All of our equipment is purchased on a budget appropriation. Hence, if the equipment is installed in the department, the cost of equipment is added to the machine tool and fixture account and allocated to the department in which it is installed. It is certain, therefore, that the cost of the product absorbs the cost of the equipment, and a sufficient reserve can be built up so that equipment purchases can be made without requiring additional capital. Depreciation continues on equipment regardless of age; that is, a machine tool would be totally depreciated at the end of 20 years, but if it is not disposed of, the depreciation continues. In this way, further assurance of getting the proper costs into the final product cost is obtained, and when it becomes necessary to replace a machine tool that is more than 20 years old, the depreciation charge to that department is not materially increased.

Figs. 1 to 10 show "Before and After" views of several of the departments and installations which have been made during the years indicated above. Operations on products of the East Pittsburgh Works require almost every type of machine tool manufactured, and due to the variety of work, it is not desirable in many cases to install single-purpose high-production equipment.

Methods Employed

As previously mentioned, during the fall of 1927 a complete survey was made of all equipment at the East Pittsburgh Works. Special attention was given to machine tools that were more than 10 years old, and these were studied to ascertain if more modern equipment would show sufficient economies to justify replacement. A selected group of men experienced in manfacturing operations and having a thorough knowledge of the equipment available from equipment manufacturers were assigned to make this survey. The information collected was recorded in both a detailed and a summarized report. It

indicated that the expenditure of approximately 2½ million dollars for replacement of equipment could be justified in approximately four years.

In order to bring this to the attention of the management and to spend this amount of money to obtain the most benefit, a definite plan for replacement of equipment year-by-year was adopted. A five-year plan allowed replacement of about one-half million dollars worth of equipment each year. This was submitted in detail and also in a summarized chart as shown in Figs. 11 and 12, which indicate the amount of money to be spent in each department and the savings possible by these replacements.

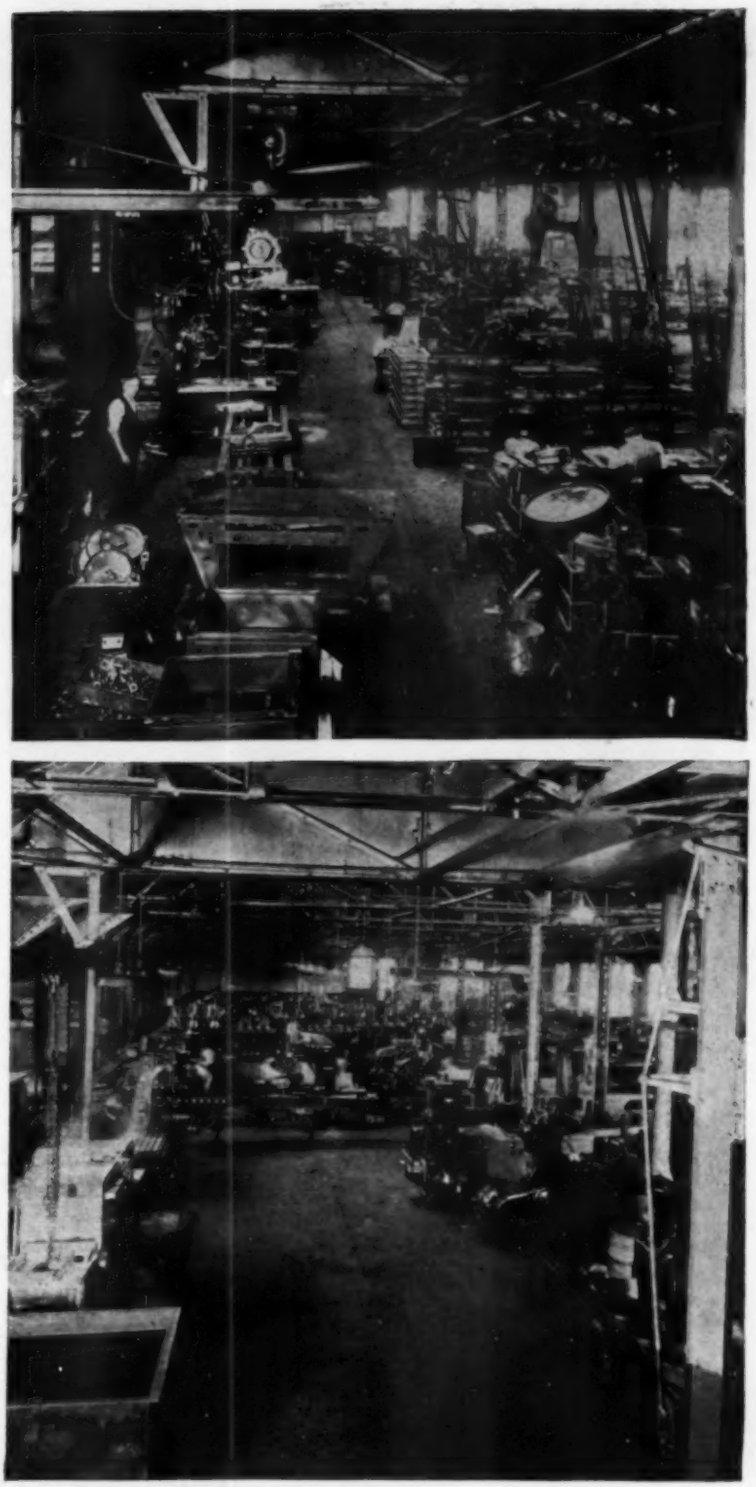
Each year this survey is brought up to date and additional equipment surveyed in order to keep the manufacturing equipment constantly at highest efficiency. It is to be admitted that a survey will show up inefficiencies not otherwise apparent. As an example, after our original survey, it was discovered that 114 machines in the various departments were not being used but were simply taking up floor space. Unless some such procedure is adopted, it may be possible to have many inefficient machines in operation; for, because such machines may not give trouble, they may not come to the attention of supervisors.

It is difficult to apply definitely a formula for replacement of equipment. There are so many factors, such as savings, accuracy, maintenance, interference in production, additional cost on subsequent operations, etc., to be considered that good judgment must be used in these cases. Also, it has been found that most formulas are too complicated or too difficult really to apply in a general machine shop. In our shop, we apply a very simple formula which indicates the length of time in which the machine will pay for itself. Savings are estimated separately and substituted in the formula because of the number of considerations necessary. It seems that values can be placed on saving of floor space, interference of production, etc., as well as saving of cost of operation, etc. However, judgment must be used so that estimated savings are not exaggerated. The formula is as follows, giving the result in years:

$$\frac{a + b - c - d}{(e - f) \times g}$$

Where:

a = Cost of new machine
b = Balance of depreciation on old machine
c = Annual cost of maintenance
d = Cost of overhaul machine
e = Present cost of product per piece
f = Estimated cost of product on new machine
g = Activity per year



A milling machine and drill press group in a detail department, as it was in 1928, and as it is today. Conveyorization, better lighting, and better tools

Following the purchase and installation of a machine tool, a time study is made on it, and new time values for the new operation are established. These time values assure obtaining the savings which were anticipated at the time of the purchase of new equipment.

Fig. 13 is a tabulation of some of the equipment purchased during this time, showing the estimated savings and also the actual savings after the machine tool was

A milling machine group in Department F-1 as it was in 1928, and a view of the same department, with better tools, unit drives, and better layout, as it appears today

installed. This was necessary in order to check and be sure that the best equipment was being purchased for the application, or to be certain that equipment purchased is showing an adequate saving.

It is difficult to establish any set time within which the equipment should pay for itself. This is entirely dependent upon the type of product manufactured and the type of equipment. We have established in general a length of time just for our own guidance. This is set up as follows:

Equipment which may soon become obsolete because of its use for the manufacture of apparatus of ever-changing design should pay for itself in not longer than one year.

Equipment purchased for operations that are more or less standard and for use on apparatus of a design not subject to frequent change should pay for itself in not longer than four years. This is average equipment which is not expensive and which, if necessary, can be used as second-hand machinery.

Large equipment that entails large investment, does not require high maintenance, and if used on equipment of stable design should pay for itself in not more than ten years.

Of course, in all cases mentioned above, judgment must be used and immediate conditions analyzed accurately.

Other equipment may be worn beyond repair or may be inadequate because of change of requirements, accuracy, lost time, etc. In these cases, a careful analysis is

DEPARTMENT	TOTAL REPLACEMENT COST OF ALL MACHINES PURCHASED PRICE IS DIS	NUMBER OF MACHINES TO BE RELEASED	NUMBER OF MACHINES TO BE RETAINED	MACHINES TO BE 1ST YEAR NUMBER	1ST YEAR COST	1ST YEAR SAVING	2ND YEAR NUMBER	2ND YEAR COST	2ND YEAR SAVING	NUMB
GENERATING APPARATUS	2568400	19	239	38	130700	45941	36	127600	39780	36
PROTECTIVE & LIGHTING	43085	2	21	1	3000	1728	1	4500	690	1
INSULATING MATERIALS	272796	—	122	10	22500	10296	7	22500	10740	5
METAL STAMPING	876705	—	267	23	33600	18256	20	47000	14280	18
STORES & SHIPPING	39150	—	28	2	1450	560	—	—	—	—
FORGE & MISC SUPPLY	381660	39	127	16	36521	12566	13	32680	10640	13
MOTOR APPARATUS	1126350	22	303	60	101975	34330	43	95250	24310	48
RAILWAY & LOCOMOTIVE	977775	3	135	70	15900	6860	8	13200	4360	11
SWITCH GEAR (E PEN)	427106	13	160	11	23200	7930	11	22425	6330	13
SWITCH GEAR (TRAFFORD)	100500	5	23	2	6000	1325	1	1000	530	1
MFG EQUIPMENT	646376	7	193	23	62250	11205	13	62350	13125	14
PRINTING	31350	1	15	6	8300	2300	2	8500	1500	2
COPPER MILL	111000	—	23	2	8450	3000	2	2000	2300	1
LINHART WORKS	42460	—	42	—	—	—	—	—	—	—
MAINTENANCE	55700	—	6	2	7900	1000	2	3200	600	2
EXPERIMENTAL	62140	1	26	6	9525	1300	3	6500	1780	2
APPRENTICE	143775	2	13	3	15500	1100	3	16000	700	3
MISCELLANEOUS	27050	—	12	—	—	—	—	—	—	—
TOTALS	7368660	114	1833	289	431471	166863	171	471825	131695	161

made by men of shop experience and, if the conditions warrant it, the machine is replaced even though there is not a sufficient amount of direct savings to justify the equipment within the time above-specified.

An accurate record is kept of all maintenance charges to equipment. This is kept on a card index where every repair to a machine tool is recorded, and is readily available when a machine tool is up for replacement. Due consideration is given to the cost of maintenance as indicated in the formula.

"Costing centers" are established for the cost of the product throughout the Works. They have a fixed rate per hour and include both direct and indirect costs. "Costing centers" are groups of similar operations or all operations to complete a part of apparatus. The department must come within this rate and if there are excessive repairs or lost time naturally this will show up in the costs and be brought to the attention of the supervisor. No separate accounting methods are necessary to take into consideration idle time of machine tools due to repairs and maintenance.

It is difficult to give a value to the advantage obtained in higher accuracy and improved quality of product. However, the savings and subsequent operation can be analyzed and should be included in the savings obtained from the machine tool. This is taken into consideration, and although there is no value placed upon improved quality or accuracy of product, it has a decided influence as to when a machine tool should be replaced.

Results Achieved

Results achieved from this plan have been numerous:

A definite plan with a schedule of action naturally allowed the management to provide for the replacement of equipment.

Westinghouse Electric & Mfg. Co.

Equipment Dept.

Obsolete Tool Record - No. 136

Machine No. 3876 Section A-16 Col. 53

Name Becker-Brainard #5-C Milling Machine

Class of Work Brush-Holders and Miscellaneous Milling Work

Purchased 1902 Original Cost $ 900.

Repairs	1925	1926	1927
	$ 51.82	$ 12.19	$ 110.63

3 Year Total $174.64 Average $ 58.21

Replacement Machine Recommended 2 Modern #5 Solid Knee Type Milling Machine

Estimated Cost $10,000.

Estimated Economies - Annual

Flat Labor	$2,520.
I.F.E.	3,276.
Scrap Elimination	
Material Savings	
Total	$5,796.

REMARKS:

Two machines recommended to replace machine #3876-3877 and 4469 (See Report #137 and 141) Combined with fixture for multiple milling.

Date 2-7-28 Recommended by Swauger - Fulton

Fig. 11—Detail replacement statement

Conditions that otherwise would have continued were uncovered, effecting additional savings.

Appropriations were spent to the better advantage of the company.

During the three years that this plan has been in effect, the actual saving realized amounts to $471,621 against an estimated saving, prior to the purchase of the equipment, of $370,623.

Workmen are better satisfied with conditions.

Fewer field charges and corrections result from more accurate work.

REPLACED — 5 YEAR SCHEDULE

3RD YEAR			4TH YEAR			5TH YEAR			5 YEAR SCHEDULE DEPT. TOTALS		
COST	SAVING	NUMBER	COST	SAVING	NUMBER	COST	SAVING	NUMBER	COST	SAVING
123450	32545	29	112360	26905	32	152950	21610	171	647050	166781
2500	576	2	1700	906	1	7000	1020	6	24700	4820
22000	6875	5	23000	8650	5	21000	8400	32	111000	44960
41550	10100	13	43800	6350	9	39100	4400	83	211450	54080
—	—	—	—	—	—	—	—	2	1450	550
31380	10265	12	23700	10226	12	31500	8280	66	156271	52905
103850	27735	39	100560	23715	41	81400	20635	223	489025	130715
63550	13400	10	58200	7250	11	66500	7850	44	223450	37400
72000	24370	3	14425	3340	7	20400	2780	57	152450	44780
1500	735	—	—	—	—	—	—	4	8500	2650
34825	4560	15	48325	6485	15	58800	6925	86	264150	42300
8500	1500	4	8700	2000	3	3400	2000	17	44000	9300
28000	4500	1	6000	1500	—	—	—	6	33450	29300
—	—	—	—	—	—	—	—	—	—	—
1980	400	1	4500	400	1	3000	200	8	19650	2600
6300	1300	2	5600	1100	2	4900	1200	15	28925	7200
12500	800	4	12500	800	5	16800	1000	18	73300	4400
—	—	—	—	—	—	—	—	—	—	—
382525	139721	146	460360	109226	144	512750	85970	838	2488971	624471

Fig. 12—The "5-Year Plan" for replacement, showing expenditures by department and possible savings by the plan

W.E.&M.CO. - EAST PITTSBURGH WORKS
MACHINE TOOL PURCHASES - SCHEDULE "A"

Description of Machine Tool	Contract Number	E-Order Number	Brass Tag No.	Plant Location	Date Ordered	Date Received	Total E-Order Cost	Annual Savings Estimated on Request	Actual Annual Savings Reported
Tube Winding Mch.	10754	5447	39406	E-5	1-6-28	3-28-28	$ 3,515.	None	$ 3,000.
9" Power Hack Saw	10802	5494	39432	P-3	2-7-28	2-21-28	930.	328.	2,300.
32" Turret Lathe	10893	5601	38780	MO-30	4-28-28	9-12-28	10,878.	3,000.	2,618.
2" V-Type Shear	11437	6086	40414	H-1	3-20-29	5-27-29	3,240.	600.	None
P-11 Vert.Milling Machine	11611	6531	40558	T-60	5-10-29	10-28-29	6,980.	None	950.
9" x 3' Bench Lathe	11619	6539	40566	K-17	5-18-29	6-13-29	735.	None	1,200.
36" Tube Cutter	11697	6637	41225	E-5	6-18-29	7-20-29	1,235.	1,130.	1,505.
6' Radial Drill	11893	6863	41367	P-1	7-23-29	10-7-29	8,110.	1,406.	2,500.
16" x 10' Engine Lathe	11908	6851	41384	MI-1	7-25-29	9-6-29	2,715.	None	None
#3 Univ. Grinder	11934	6900	41430	W-50	8-8-29	11-22-29	3,565.	None	1,175.
#2-a Turret Lathe	12237	8244	42123	K-30	11-5-29	11-29-29	4,852.	953.	1,997.
16" x 6' Engine Lathe	12328	8341	42210	S-6	12-18-29	3-20-30	2,110.	None	840.
42" Shaper-Planer	12438	8460	42264	P-71	2-5-30	3-17-30	5,440.	3,265.	5,746.
72" Boring Mill	12477	8495	42815	P-71	2-20-30	6-11-30	15,380.	1,224.	1,613.
6" Vertical Shaper	12444	8465	42281	W-52	2-14-30	3-24-30	3,515.	765.	956.
5" Centering Mch.	12703	8690	42940	MF-3	4-28-30	7-9-30	2,405.	450.	192.
36" S.H.Boring Mill	12583	8592	42880	T-60	4-2-30	4-22-30	8,315.	600.	1,870.
#4 Plain Milling Machine	12480	8508	42858	P-3	3-21-30	4-10-30	6,085.	1,248.	800.
20" Shaper	12791	8783	43031	F-1	5-29-30	7-7-30	2,725.	300.	None
#1 Plain Milling Machine	12827	8854	43071	MI-1	6-26-30	7-11-30	2,670.	None	None
#43 Granulator	12824	8843	40348	MX-15	6-11-30	7-1-30	450.	None	150.
6' Portable Radial Drill	13301	1250	44614	D-1	3-5-31	5-20-31	7,311.	None	None
			Total - This sheet				$103,161.	$15,269.	$29,412.

Fig. 13—A tabulation of some of the equipment purchased, showing estimated and actual savings

Works delivery cost was reduced approximately 4 per cent, partially due to the replacement plan.

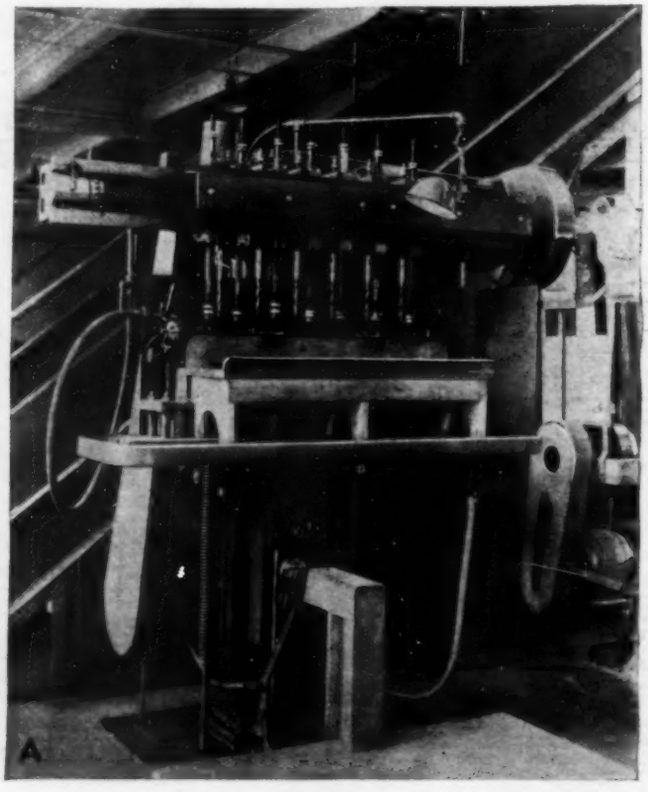
The remaining illustrations show several specific cases of cost reduction by the replacement method. In each case results of the replacement are summarized in a table.

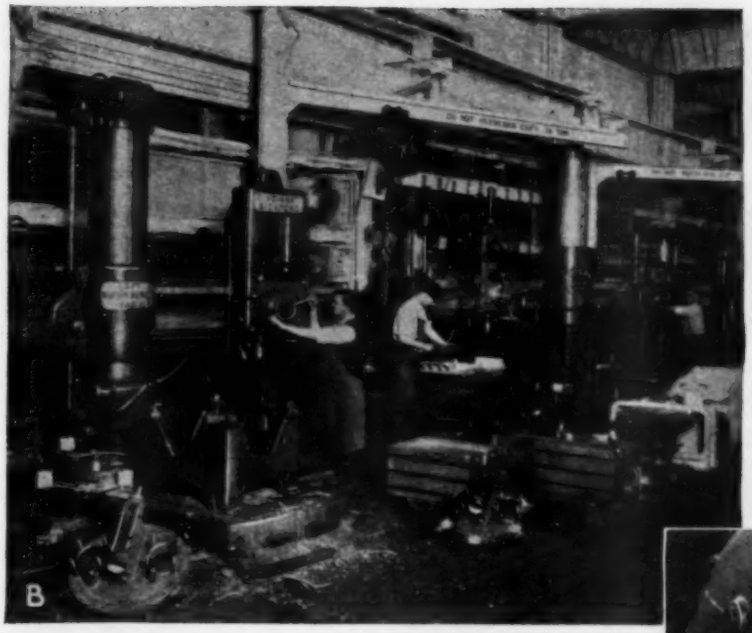
Summarizing the plan briefly: Survey your equipment by actually seeing the conditions of machine and product. Analyze the possibilities if modern equipment were used. Prepare a definite plan of action; then put the plan into effect.

Replacement Examples at Westinghouse

EXAMPLE A

Description of Machine	No. 4—4-ft. Driller
Cost	$2,000
Replaced	Single-Spindle Drill Press
Date Purchased	This press remained in this department on other work
Cost of Overhauling	
Estimated Saving	$371
Actual Saving	$1,800





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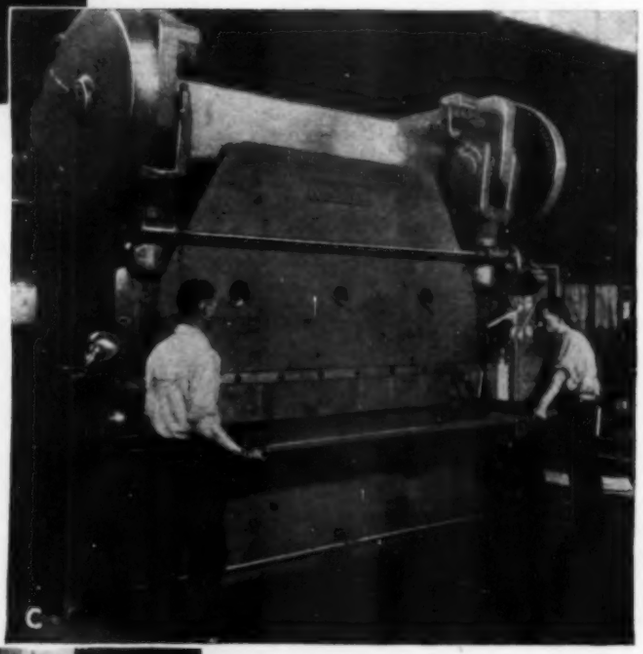
EXAMPLE C

(Below)

Description of Machine	Series 120x8-ft. All-Steel Press Brake
Cost	$5,856
Replaced	Hydraulic Bender Press
Date Purchased	1915 1910
Repair Cost	$3,200 $1,000
Cost of Overhauling	$1,000 $750
Actual Savings	$3,808

Note—As a result of this installation a second press brake was purchased to replace a double-crank press.

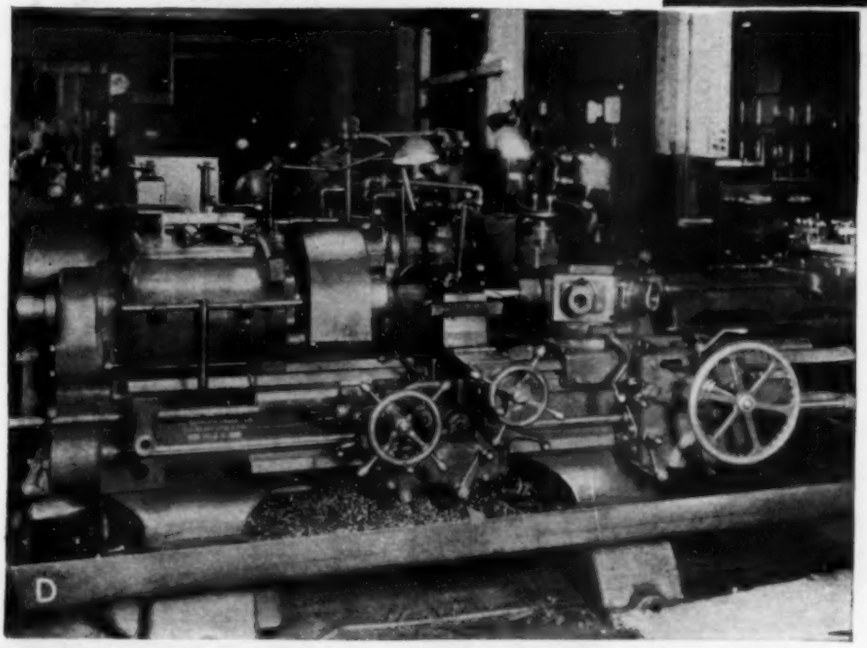


C

EXAMPLE B

(Above)

Description of Machines	One 6-ft. 19-in. diam. Column Heavy-Duty Radial Drill Press	Two 5-ft. 17-in. diam. Column Radial Drill Presses.	
Cost			$20,000
Replaced	Three Radial Drill Presses		
Date Purchased	1914	1914	1923
Repair Cost	$1,250	$1,250	$1,352
Cost of Overhauling	$2,500	$2,500	$800
Actual Savings	$2,400 each		



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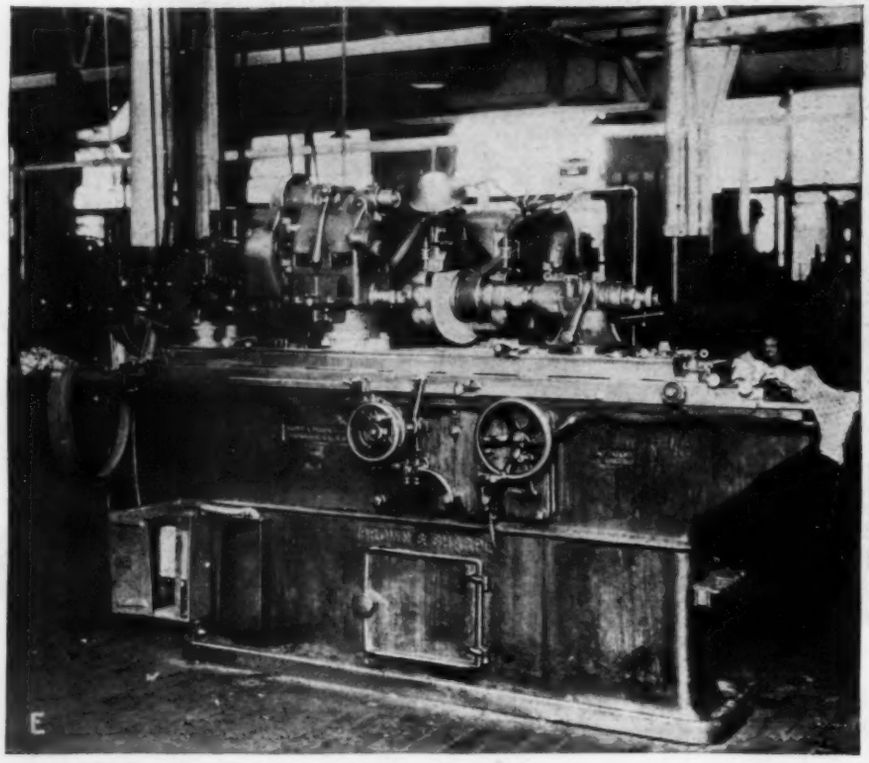
EXAMPLE D

Description of Machine—	Universal Hollow Hexagon Turret Lathe
Cost	$4,467
Replaced	Turret Lathe
Date Purchased	1912
Repair Cost	$2,324
Cost of Overhauling—	Not Justified
Actual Savings	$1,997

EXAMPLE E

Description of Machine—
No. 3 Universal Grinder
Cost $3,015
Replaced ..... Universal Grinder
Date Purchased 1900
Repair Cost $1,500
Cost of Overhauling $1,600
Saving $1,175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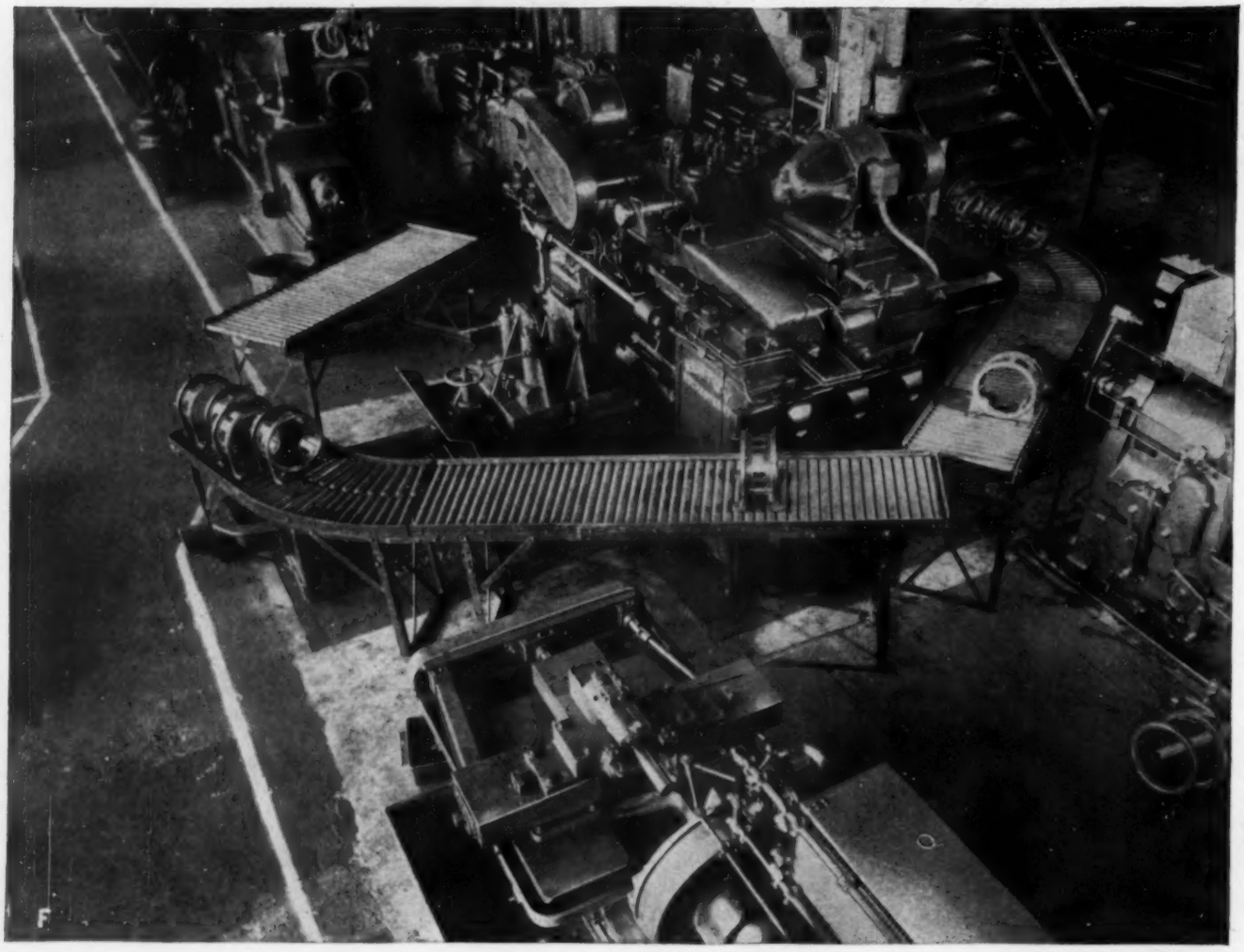
EXAMPLE F

Description of Machine—
Special Four-Spindle
Motor-Frame Milling Machine
Cost $15,140
Replaced—
No. 5 Plain-Type Milling Machine
Date Purchased 1919
Repair Cost $600
Cost of Overhauling—
Machine was transferred to other work
Actual Savings $1,365

This machine will produce considerably more work but on our jobs, it shows the above actual saving. Also it has a special attachment that will mill without distorting the motor frame.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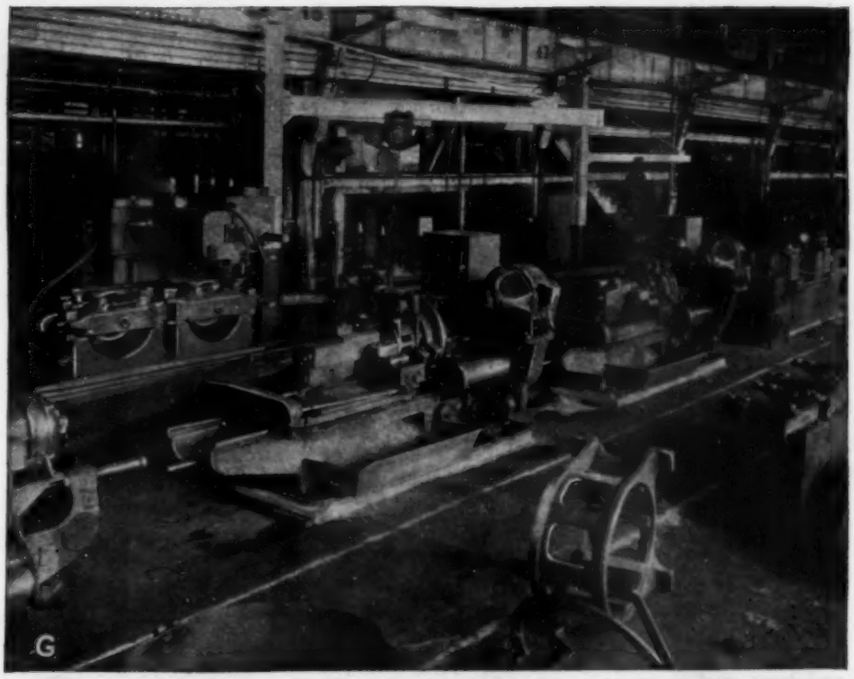


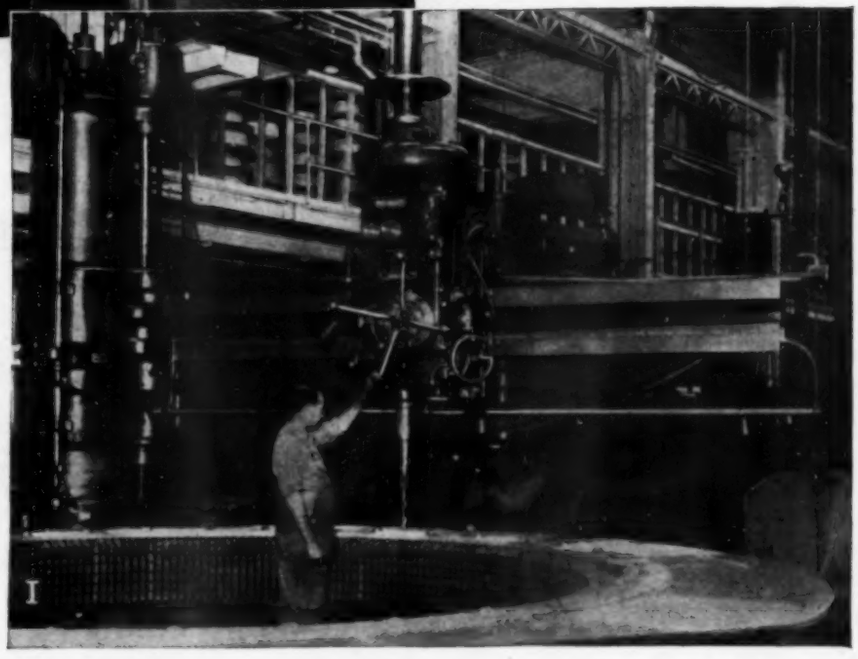
EXAMPLE G

Description of Machine—
45-60-in. Hydromatic Miller
Cost $11,670
Replaced... Slab Milling Machine
Date Purchased 1907
Repair Cost $2,400
Cost of Overhauling.. Not Justified
Actual Saving $1,000

Description of Machine—
Two Simplimatic Lathes
Cost $19,376
Replaced. Four 42-in. Boring Mills
Date Purchased 1907
Repair Cost $1,500
Cost of Overhauling.. Not Justified
Actual Saving..... $4,500

EXAMPLE H

Description of Machine—
Four Simplimatics
Cost $18,204
Replaced Five 30-in. Boring Mills
Date Purchased 1907
Repair Cost..... $1,000 each
Cost of Overhauling.. Not Justified
Actual Saving $5,800



EXAMPLE I

Description of Machine—
12-ft. Radial Drill Press
Cost $14,965
Replaced...10-ft. Radial Drill Press
Date Purchased 1907
Repair Cost $2,526 for last 10 years
Cost of Overhauling..... $2,000
Actual Saving $803

The Foreman's Round Table

'Till It Hurts

"LET'S eat," hailed Ed as he entered Al's office. "I haven't had a decent meal since that doctor stepped into my family affairs. I'm going to order a big juicy steak, smothered—"

"You're going to order ham and eggs, that's what you'll order," interjected Al. "Come on, let's go anyway."

When, sure enough, Ed had ordered ham and eggs, the conversation inevitably came around to the depression.

"Say, Al, Joe Black told me one of his sisters says that where she works they are going to deduct one day each month from the men's pay envelope to help the unemployed."

"What do you mean, deduct? Is it voluntary or forced?"

"Vountary nothing! Joe said a notice had been posted over the president's signature, without any request for volunteer subscriptions or anything else."

"Maybe he knew it would be useless. Our old man is thinking along the same lines, but he aims to make it voluntary."

"Well he won't get anything out of me. I'll tell him that. What with doctors' bills and other subscriptions, and taxes, I expect to go on the town myself before long."

"Yes, I know, Ed, but think how much worse it would be if you had doctors' bills to pay and no job."

"I've heard that line before. Everybody is yelling about higher taxes. But I can't see any difference between being taxed to death and being solicited to death. If you don't pay your taxes they force you to or take your property away, and it looks like they were trying the same thing with contributions."

"I think your remarks are justified in a way, Ed, but not altogether. Thousands of tourists are spending money in Europe that would help trade here. Hundreds of thousands are sending money to support their relatives or nationals in the Old World. Other organizations are active in soliciting for the 'Near this,' and 'Far that' charities when we might all better be supporting the 'Near home' charity. And that's what I purpose to do."

"Yes, so do I, but I object to force."

"But you can't be fair to those willing to contribute unless you do something like that. The others simply will not give. Take the guy that thinks the rich should pay all taxes and benefactions; take the guy that is so stingy he won't even contribute when he goes to church; and that type of foreigner who takes everything, gives nothing, and does his banking in his own country. How about them? How are you going to get at these kinds of people if you don't make it compulsory?"

"Well they might ask first for voluntary subscriptions, and then make it compulsory."

"Why waste time and stir up controversy? Some men like yourself, would find some moral justification for their failure to contribute, others wouldn't need any reason for not giving, and the poor willing horse would get it in the neck as usual. Lots of men will be glad to have the decision to give made for them."

"But, Al, it will cause trouble. If it comes to that, no president can take money out of your pay envelope without your consent. There's a law that says so."

"Maybe there is, but suppose the notice reads, 'unless written objection is made, etc.' Who's going to object."

"Not me, in writing."

Is compulsory action justifiable in a crisis? What is the alternative if any?
Suggested by H. L. Lackman

Discussion of Former Topics

Traffic Congestion

I believe that there are plenty of excuses for stoppage of operations other than failure of tools. These might be cited as unanticipated flaws in raw material, changes or check-ups on engineering specifications, emergency rush orders, illness of man, etc. In any consideration of the problem, however, the excuses are the least important aspect of the situation—the fact remains that the foreman is selected and paid for ability to keep things flowing smoothly and efficicently, not for his literary imagination in providing plausible alibis. Without attempting the detail of instances each of which remains an individual case, when the average foreman concentrates on a contemplated stoppage, he can usually avoid it. There is in every production organization, no matter how tightly scheduled or planned on paper, a certain amount of slack. The only trick is to make up one's mind to search for it and find it.

As to sending in reports, I believe the practice will be a distinct help—not for the value of the report itself, but merely for the fact that it focuses the foreman's attention on the matter. The report itself might just as well be routed to the little round file at the side of the desk for all the good it might do if written—the trick is that many a stoppage dies in the making because it requires that report in order to become legal. So it isn't the actual reports that help, but the reports that are never written because another way out is found instead.

—D. R. Watson.

Run-of-Mine

The rate of pay prevailing in a shop certainly has some influence on the grade of mechanics seeking employment there. It is not, however, a correct gage of the standard of skill existing in the factory.

Strange as it may seem, there are still a great many mechanics, young and old, who would rather work for a few cents less a week in a plant demanding quality than in some of the modern "merry-go-rounds" in which thinking and personal initiative are not wanted. During the recent boom in the aircraft industry, employees in well-established plants received many offers, some of which were not only flattering but represented considerably more money than the individual could earn for the corporation making the offer. Despite these conditions, few key men were lost. Probably the greatest incentive that can be offered a workman is steady work at a fair wage.

As to the question of clerical help versus factory help, I must confess that I don't get the point at all. I have met good, bad, and indifferent in both classes. It is my firm belief that the intelligent youth of today avoids industry not through fear of soiled hands and clothing, but through fear of the policy adopted by many establishments, "Men over 40 need not apply." These boys are not so dumb, at that.

Jos. T. McDevitt, *Timekeeper, Naval Aircraft Factory.*

On the Spot

Every foreman is placed in charge of his department to center the responsibility in one man. He must get the work done as accurately as necessary and as speedily as possible with the equipment furnished him. The efficient performance of these primary duties require him to remain in his own section of the plant continuously, yet he must contact with various people in the rest of the plant to coordinate the efforts of his men with the production of the whole plant. Many questions arise, which closely concern his department, and unless some regular procedure is established to handle them, there will be much confusion and unnecessary running around.

The efficient foreman gets his work done in an orderly manner without a lot of fuss and uproar. He will make few personal visits, doing a large part of his question answering and information hunting over the telephone. When he must leave the department, he will make each trip take care of several things that require his attention. Outside of emergency cases, he will try to handle all outside contacts at a certain regular period every day. But the cooperation of all department heads and clerks is required in any attempt to reduce the number of interruptions. More than anything else, a generous use of common sense by all concerned will be helpful in eliminating most of the unnecessary distractions.

—L. O. Brown.

Service or Ability?

I do not believe it is right to go outside of the plant for a new assistant foreman. There are men in every plant who are very quiet, but who pay attention to business day after day, year after year. These men are not of the nature to thrust themselves into the limelight, nevertheless if given the opportunity, these men would surpass many of the imported foremen.

One may say that the men in the shop have not the ability. Has anyone ever given them a chance to prove their ability along executive lines?

If a man has been with a concern for a number of years he must have some good qualities, or else he would not have lasted so long. No doubt he knows quite a lot more than he has ever been able to show. With responsibility resting on his shoulders, the results might be a surprise. If encouragement of this sort is given, it will certainly raise the average ability of the men in plant.

—Maurice W. Baitler, *Perkins Mach. & Gear Co.*

Treasure Chests

Emerson's essay on teachability is applicable to the foreman of a machine shop. He believed that the secret of the true scholar is, "In every man there is something wherein I

may learn of him, and in that, I am his pupil." To a foreman, who realizes this attitude, every personality has a wholly new value to him. He will not attempt to dominate and subject every other personality to his own, but will instead, find himself drawing out expression from others. When this happens, he will not only broaden and grow, but he will rise in the esteem of others. Anyone appreciates an ear attentive to his own ideas, and is worthy of it if his ideas have a thoughtful basis. It may be true that many machinists work mechanically, with no particular mental alertness to their task. But there are many who have a ready eye for points of improvement. Most workmen, however, hesitate to give expression to such observations because they fear the foreman will object to being told how to "run his business." Unfortunately this is frequently true. However, the alert workman generally sees some opportunities for short-cuts and improvements, overlooked by the foreman, simply by virtue of his greater familiarity with the job.

—H. L. LACKMAN

Carelessness

The nature of my work has given me good opportunity to note what type of man makes the most and greatest mistakes. It may surprise some, when I say that the superior intellectual are prominent amongst the spoilers of work.

The brainy man has a weakness for day dreaming. When engaged on his daily work, especially when it is of a repetitive nature, his mind is prone to wander. Day dreaming is not usually favorably viewed, although one writer has said, "The dreamers are the saviours of the world." To dismiss these dreamers is not to the interest of the company, for they may be the executives, organizers and the designers of the future. Their value tomorrow outweighs the errors of today. Men of this type need careful diplomatic guidance, for the finest of intellect is only of value in direct ratio to the amount it is kept in harness.

Another intellectual type that makes a lot of scrap, is the young man full of energy, ambition and enthusiasm, but lacking in caution and discretion. He tackles everything, heeds no advice, dodges the foreman and floor inspector, and then usually finds the wrong way of doing the job. Men of this type are difficult to deal with, as they never like to be told, and if they cannot go along in their own way, they get sullen.

The third intellectual type who feeds the scrap pile, is the brainy young man, who is using all his mentation on outside interests, and instead of his mind being on his work, he is probably planning and organizing activities for the coming evening or season.

The steady, stolid, plodding worker on repetition work makes few mistakes, for he has but little brain to go wandering. Many such men have learned to concentrate and make the most of their small share of brains, and scrap far less than the brainy man, who cannot keep his thoughts centered on his work.

—A. C. LAYZELL.

On the Spot

Much of the foreman's running around in the plant can be prevented by the use of the plant telephone. As soon as the foreman leaves his department it seems to be human nature for some of the workers to find something to talk about to one another, or a joke to tell. In most shops questions are raised about materials, dimensions, etc. The worker must wait the foreman's return, or in the meantime, go ahead and possibly make a mistake, because the foreman is running errands a boy should, or looking up information a clerk could do.

—J. C. WATSON,
Superintendent,
Franklin Potteries.

Treasure Chests

While the suggestion box has somehow dropped into the background recently, it cannot be said to have failed where the idea has been given a fair trial. In shops where suitable rewards are given, many worthwhile ideas have been received and acted upon.

In my opinion, the shop foreman should have no access to the box, all suggestions being submitted to a methods engineer who in turn could consult the foreman as to the merits of the idea without revealing the identity of the workman responsible.

In this way, many worthwhile ideas which would otherwise be rejected by a foreman on purely personal grounds, would reach the proper quarter, and those schemes which were obviously imperfect would be rejected without incurring any bias.

As far as the suggestion box scheme is concerned, I am strongly in favor. The cost is negligible and the benefits to an organization are at once apparent in an interested and awakened personnel.

—ROBERT S. ALEXANDER.

Run-of-Mine

So Ed thinks that the shop man is of the physical type and the office man of a mental type? If you should select fifty men at random from the men working at machines in the ordinary machine shop and fifty more at random from the office, and get them into a fight, I would bet on the office men. The shop men are doing physical work, but much of it is no more physical strain than a typewriter. Of course, there are factory jobs that require physical strength, and for them you will find strong men, but they are the exception.

A number of measurements have shown that in general men with good minds are more likely to have strong bodies. The office has the first chance at selection. They get the best minds, and with them they get a large share of the physically strong. The shop takes what is left.

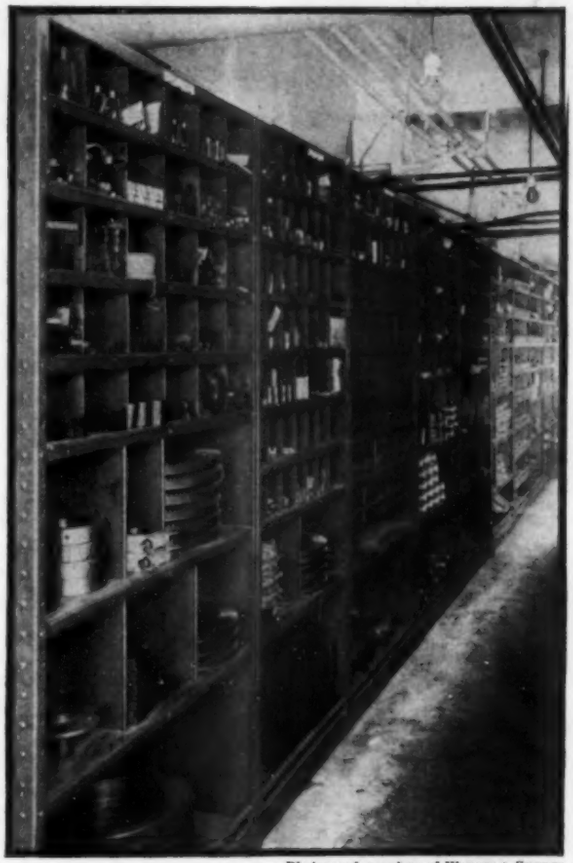
—A. W. FORBES,
Forbes & Myers.

Service or Ability

There are two considerations in filling a position in which possible promotion is involved. One is that the new incumbent must be qualified to perform the duties, and the other is the effect upon the other employees. In filling such a position, the writer always tries to select a man from inside the organization if possible, and to give reasonable preference to seniority; but the man must be capable of doing the work and must enjoy a harmonious relation with his fellow workers so that his promotion will not cause resentment. Where such a man cannot be found within the organization, I prefer to go outside, even though this may cause ill feeling. Men will always respect demonstrated ability, and a new man of the right calibre can usually live down any ill feeling among the older employees.

—D. L. PARKHURST,
U. S. Coast & Geodetic Survey.

Stocking Parts for Old Machines



Photograph courtesy of Warner & Swasey

All inventories are under suspicion, yet customers continue to look to the machine manufacturer for service even when their equipment has become obsolete. Making and storing parts for repairs proves burdensome when the demand for them falls below a certain point. Obviously, there must be a time limit beyond which a supplier cannot be expected to furnish parts for old machines except on special order

DEANE S. HAZEN
Industrial Counsel

WHAT items in the inventory can be discontinued without serious effect on the sales demands of customers? The problem is the more acute at present because of the absolute need of reducing the number of inventory items to a minimum and of concentrating all manufacturing work on those parts which are made and sold most profitably. This, too, is aggravated by bringing out numerous new types of machines which tend to increase stock items.

It has been a common custom in the past to worry more about possible shortages in the stockroom than about the more usual overstocking of parts. In turning the spotlight on the stockroom inventory, such glaring instances of overstock become apparent that there is a hurried attempt to reduce amounts without careful study of effects. If an accurate inventory record has not been maintained in the stockroom over a period of years, it will be necessary to analyze the sales records of repair parts shipped and to build up a temporary record of those items shipped more or less infrequently. This can be simplified at first by studying the records of repair parts shipped for use in machines that are now considered obsolete by the manufacturer.

Looking over these records, it is easy to pick out many items that have been somewhat stagnant in the stockroom for several years back. Before deciding what items to discontinue, it is necessary to see what causes obsolescence. Parts become obsolete in three ways: first, by changes in the design of certain parts of machines so that the older parts are no longer needed for construction; second, by the replacement of certain parts by newer parts that can be used for both construction of machines and for repairs; third, by the abandonment of the manufacture of specific types of machines, leaving the repairs of customers' machines the only need for the parts. The use of parts in the construction of machines is an internal engineering problem, but the need of parts for the repairs of machines, already sold and being used by customers, is an external problem involving the question of sales policy as well as manufacturing costs.

The cycle of "active to obsolete" is a simple one:

First, a new type of machine is built and all parts are up to date.

Second, changes are made in machine design which renders certain parts obsolete as far as future machine construction is concerned. The new parts substituted may or may not be interchangeable with the parts they have replaced.

Third, the machine itself is discontinued, thus rendering all parts obsolete for future construction.

Fourth, the machines in use by customers gradually are replaced so that repairs are not needed.

Now as this cycle takes place and a part is no longer required for assembly purposes, the need of continuing the manufacture of the part for repair purposes can be determined only by one thing and that is the customers' demand.

A summary of amounts, used over a period of years, must be used. These amounts are separated into those used for construction and those used for repairs. The latter are then subdivided into two parts; first, those which can be replaced without reconstruction by the new parts; second, those which cannot be interchanged with

newer parts of slightly different design or construction. The first items will be abolished gradually as the stock runs out, newer parts are substituted, and so need cause no worry. The second group must be considered not only in the light of the amounts used but also in regard to the policy of keeping old customers satisfied as far as reasonably possible.

The amounts to be manufactured must be determined by actual figures of yearly sales of the specific parts until the quantities reach a point where their manufacture is too costly. They then become a sales problem. A brief example of this may illustrate it more clearly. Suppose the stock records show as follows:

SUMMARY OF ISSUES FROM STOCK OF PART A-1

Use	1926	1927	1928	1929	1930
1. Machine assembly..	500	700	300	100	150
2. Repairs.....	350	500	400	150	200
Totals.....	850	1,200	700	250	350

Assuming that no more machines requiring this part are to be built, the "Machine Assembly" amounts may be ignored, and the "Repair" figures are used as a basis of determining future production of the part. If a newer part, say A-10, is interchangeable with the old A-1, then these stock records may be combined with the A-10 stock records, and the total of the two used as a basis. A-1 will then gradually disappear. But if A-1 is not replaced by a new part and is entirely alone in its obsolescence, its specific records under "Repair" is the only true basis to determine whether or not to continue making the part and what quantities are to be made. In this assumed instance, a six months' supply of 100 pieces would be a fair manufacturing amount assuming that such an amount can be profitably manufactured.

Let us suppose that another part shows a different story:

SUMMARY OF ISSUES FROM STOCK OF PART B-1

Use	1926	1927	1928	1929	1930
1. Machine assembly..	400	600	100	0	0
2. Repairs.....	200	300	100	75	55
Totals.....	600	900	200	75	55

If this part B-1 is not being replaced by an interchangeable part, then it is evident that the demand will continue although in continuously smaller quantities. Now there enters into the problem the matter of sales policy, and sometimes although manufacturing costs are rising on individual pieces so that no profit is evident, it may be advisable from the sales manager's point of view to continue to stock small amounts of the item to keep his customers satisfied. For example, a six months' supply of 25 pieces might be advisable even though manufacture is unprofitable.

As the amounts to be manufactured grow smaller because of the decrease in demand, the cost per piece will steadily mount, and the selling price will be seriously affected. Although in general, it will be possible to increase the selling price to cover the higher cost, there will come a time when the cost will be so high as to make the selling price prohibitive, and the matter of sales policy will again enter in. It is evident that later the amount of parts needed will be so small that the item will become practically a special order, and the selling price will have to be considered as special with every sale.

Cutting Materials, Yesterday and Tomorrow—*Discussion*

DONALD RAEBURN
Glasgow, Scotland

In the splendid articles on cemented tungsten-carbide tools (*AM*, Vol. 74, pages 929, 979), there is one important point on which no information was given. That is the effect of a suitable lubricant for the purpose of relieving tool pressure and assisting chip breakage. A number of years ago in the pages of this journal the attention of readers was directed by a contributor to the fact that with an adequate supply of the proper lubricant a greater depth of cut could be taken, using high-speed-steel tools. Immediately the supply of coolant was cut off the machine failed to drive. Owing to the heat generated, the tool became unable to sever the cut at that particular speed, although the cutting edge when examined was found to be in serviceable condition. This experiment was carried out on a vertical mill. The removal of metal by shearing action is common to all machining operations, and heat is generated in proportion to the power expended in performing the work. The amount of heat produced is dependent upon the weight of the cut removed, the cutting speed and the material properties of the metal being machined. There is also a second source of heat which must be taken into account, and that is the frictional heat caused by the material when being severed, sliding over the tool. This heat cannot be avoided. It is cumulative, but it can be controlled, and in the control of generated heat will probably be found the solution of chip breakage when using tungsten-carbide tools. Coinciding with the control of heat is the fact that the brazing process is made more efficient as the suggested nickel-steel shanks are removed from the danger of overheating and unduly expanding thus causing the tungsten-carbide tip to loosen or crumble.

The suggestion of Mr. Baumgartner of forming a chip breaker on the tip is well known among machinists, but when the speed is considered together with the strength of material being machined, the danger to the operator through flying chips caused by the adoption of this method must receive serious consideration. Advocating the negative back rake, particularly for heavy lathe tools, seems to invite controversy, as a further increase in the tensile strength and hardness of metals would increase the negative back rake with a resultant increase in tool pressure. In machining metals of a comparatively low tensile strength, using high-speed tools, it can be observed, particularly in lathe work, that the chip often curls from the tool to a length of ten feet or more, and the machinist must break the chip.

Recently a prominent firm of machine-tool builders placed on the market a heavy, multiple-tool, parting machine. This machine parted the material, leaving a core of about 3½-in. diameter, each pair of tools having a liberal supply of lubricant. After parting, the work was laid upon the floor and the disks were broken off quite easily with a heavy hammer and wedges. While the plentiful supply of coolant lengthened the life of the tools, it also performed the important duty of carrying away the heat and enabling the operator to break off the disks immediately after removal from the machine. Had the heat not been kept under control, any attempt to separate the disks would have been difficult because of the stretching of the hot metal.

Erecting Modern Printing Presses

▼

Many a tedious assembly operation has been eliminated through jig machining of parts. As a result, presses now leave the erecting floor in a fraction of the time formerly required. Details of press assembly are given in this article, the second in a group of three describing modern production methods as applied to a product formerly made piece by piece, job by job

SOME of the striking changes that have taken place in erecting large presses are shown in the illustrations that follow. Discarding the old method of clamping brackets and other parts to the frame, locating them in position by plumb bob, square or level, and then drilling the holes by bolting, R. Hoe & Co., Inc., has developed ways and means to jig drill both the parts and the frames. Frames and bedplates are now planed with a lining strip for checking alignment in erection.

Large bedplates are, of course, made up in sections, and the first step in erection is to be sure that these sections are square on the ends and in perfect alignment along the rail. This alignment is checked as in Fig. 1 by means of a wire stretched along the bedplates after they are bolted together as shown. The wire is located a given distance from the straight edge, or lining strip, that is planed on each piece, and the space measured by gages as shown at *A*. These gages carry a crosspiece at right angles fitting against the planed edge of the plate.

It requires accurate planing to get all the joints square with the edge, but little difficulty is now experienced in this direction. Should any misalignment be found, the offending joint is replaned where necessary. It will be noted that the frames are mounted on special screw jacks

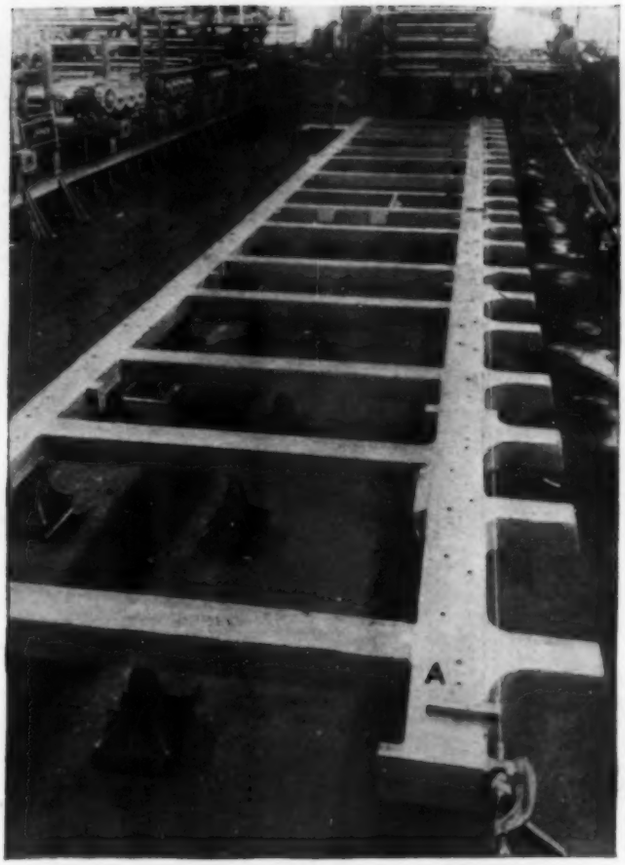


Fig. 1—Holes are located from an aligning strip, planed at the edge of each bedplate. Leveling blocks plus a taut wire insure accurate set-up

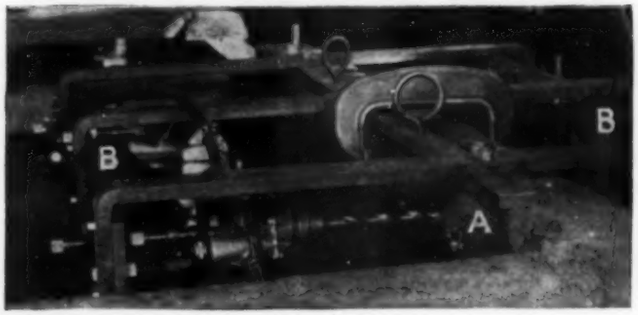
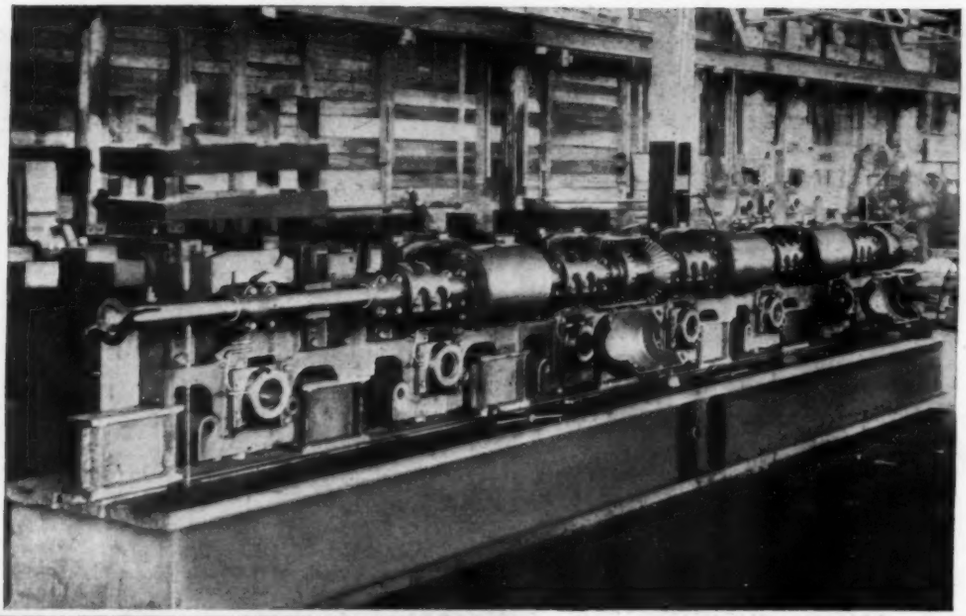


Fig. 2—A special double-ended "old man" serves to feed the pneumatic drill and acts as a jig

that can be easily leveled and that distribute the load over many points. All the vertical holes are jig drilled in the frame before they reach the erection floor. In the old days these were all drilled by hand.

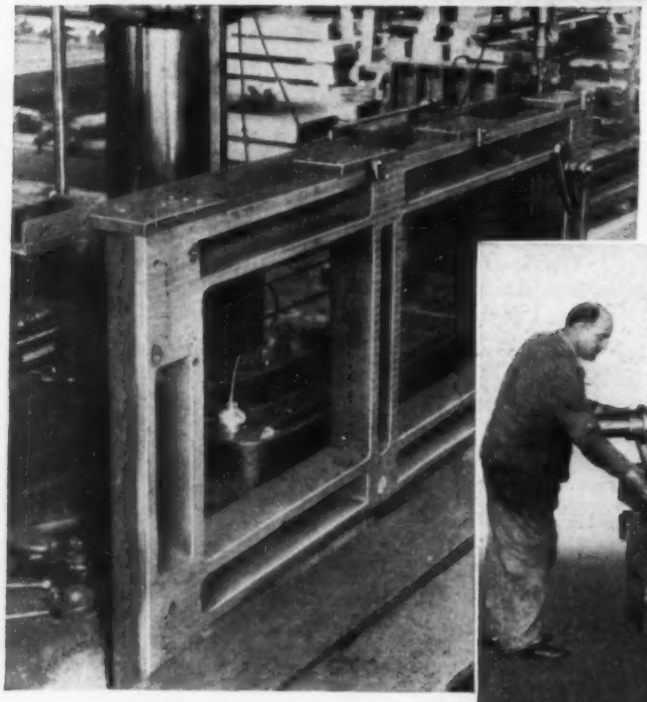
Some of the horizontal holes are still drilled after the frame is on the erection floor but not by hand as formerly. These holes are now drilled by air motor with the aid of a special double-sided "old man," as in Fig. 2, which has proved a great time saver. It helped to make the world's record in erecting large presses in 1927. This was a 12-cylinder Universal type press with two double folders for printing black and color. Fig. 2 also shows the start of the press on the erecting floor. It was completed in thirteen days, including the preliminary run and first inspection. The saving on 56 such bedplates was 649.6 hours.

The central T-shaped bar *A* is planed square to locate



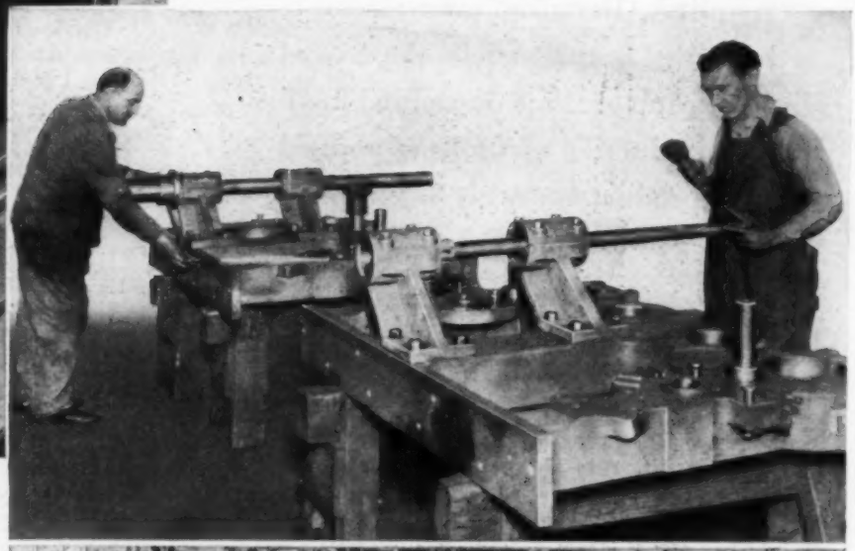
ABOVE

Fig. 3—Shafts, brackets, and gear guards are lined and assembled in about one-fifth the former time



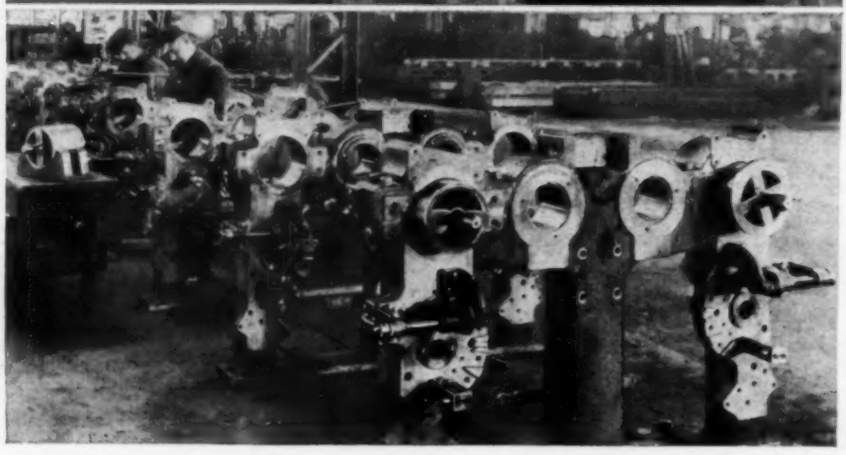
LEFT

Fig. 4—The handling of large bedplates is simplified by a pit beneath the arm of a large radial drill



RIGHT ABOVE

Fig. 5—After line-reaming, bearings are checked for squareness by means of a special tram



RIGHT BELOW

Fig. 6—Cylinder block holes are scraped to mandrels, cored out of convenience in handling

it on the frame. It carries three double-ended bars, bent at the ends to support the cross bars *B*. The plate *A* is drilled for bushings at the proper points, and the plates *B* have heavy capscrews at points opposite the bushings to take the thrust of the drills as shown.

A C-clamp holds the bar *A* to the frame and it is an easy matter to shift the air drill for drilling any hole in the jig plate. The feed screw of the drill rests in the countersunk end of the heavy capscrew that backs it up and can be fed either by the screw on the drill or by the capscrew on the outside.

In Fig. 3 is another example of the new method of assembling presses, this being the final side frame assembly in which the frames are lined up and bolted together, the vertical shafts and brackets assembled, and gear guards put in place in 14½ hrs. per pair of frames. By the old method, the drilling was all done during erection and required 69.6 man hours.

Joint holes in the bedplates are drilled with the simple jig in Fig. 4. The four bushing plates are fastened to a substantial angle and carry standard drill bushings. The stops at the right-hand end locate the end bushing plate, clamps on the next two drawing the angle against the other side of the casting. A suitable pit under the radial aids in handling large bedplates.

After various units are machined, they are gathered for subassembly as in Fig. 5. Brackets are bolted to the side frames and then line-reamed to insure perfect alignment and to give the desired running clearance instead of scraping as formerly. The next step is to check the reamed holes for squareness with the frame, using the tram shown at the left. The arm of the tram is held in a heavy collar that slides over the test bar. Swinging this bar from one side to the other checks the squareness much more accurately and rapidly than was possible by the old plumb line method previously used.

Scraping is, however, still used where it seems best, as in Figs. 6 and 7. In the first instance, cylinder box holes are being scraped on both diameter and face to the hollow master mandrels shown. These are handled so much more easily than the cylinder boxes themselves that the saving in time and labor is considerable.

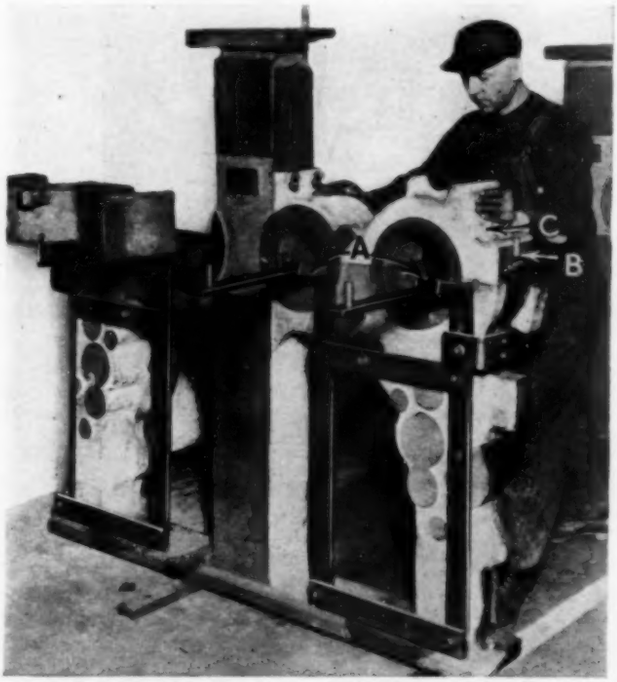


Fig. 7—A crane and a helper are eliminated by this method of fitting caps. The cap is supported by a special bracket while the scraping is done

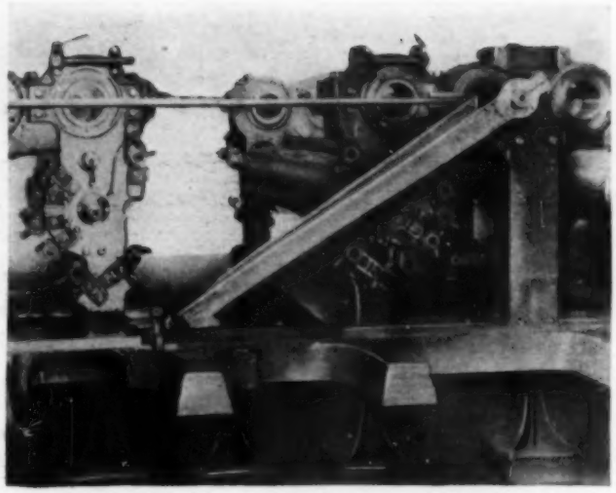


Fig. 8—Side frames and cylinders are aligned with the bedplate using a long tram and an indicator

Fig. 9—Swinging the arm in the opposite direction provides location from two points on the bedplate about ten feet apart, insuring a high degree of accuracy

Another time saving method is shown in Fig. 7, where large bearing cap faces are being scraped to the desired fit. These bearing caps are heavy and would require a crane for handling but for the brackets shown bolted to the side frame. Each arm of these brackets carries a roller bearing shoe *A*, making it easy to slide the bearing cap out on the arm, the stop pins preventing it from accidentally falling off the end. In addition, the spring *B* presses a roller *C* against the end of the cap keeping the other end in contact with the center upright of the frame. By interposing this roller the friction of the spring is greatly reduced.

One method of checking alignment is by a long 72-in. tram as in Fig. 8. The upper end carries a bar that just fits the large roll bearings in the upper part of the frame

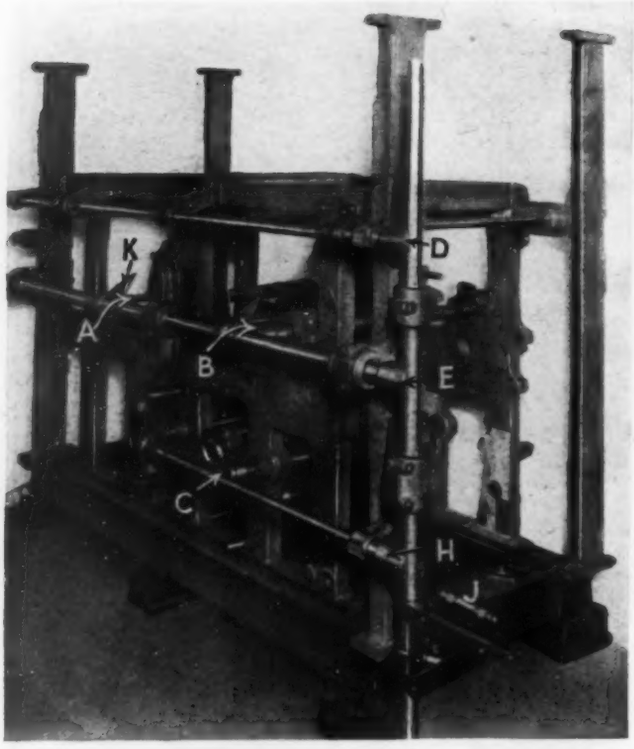


Fig. 10—Forked mandrels, a square, and a level position the vertical shafts

Fig. 11—The heavy main bearing brackets are also located by slotted mandrels. Antifrication bearings are used

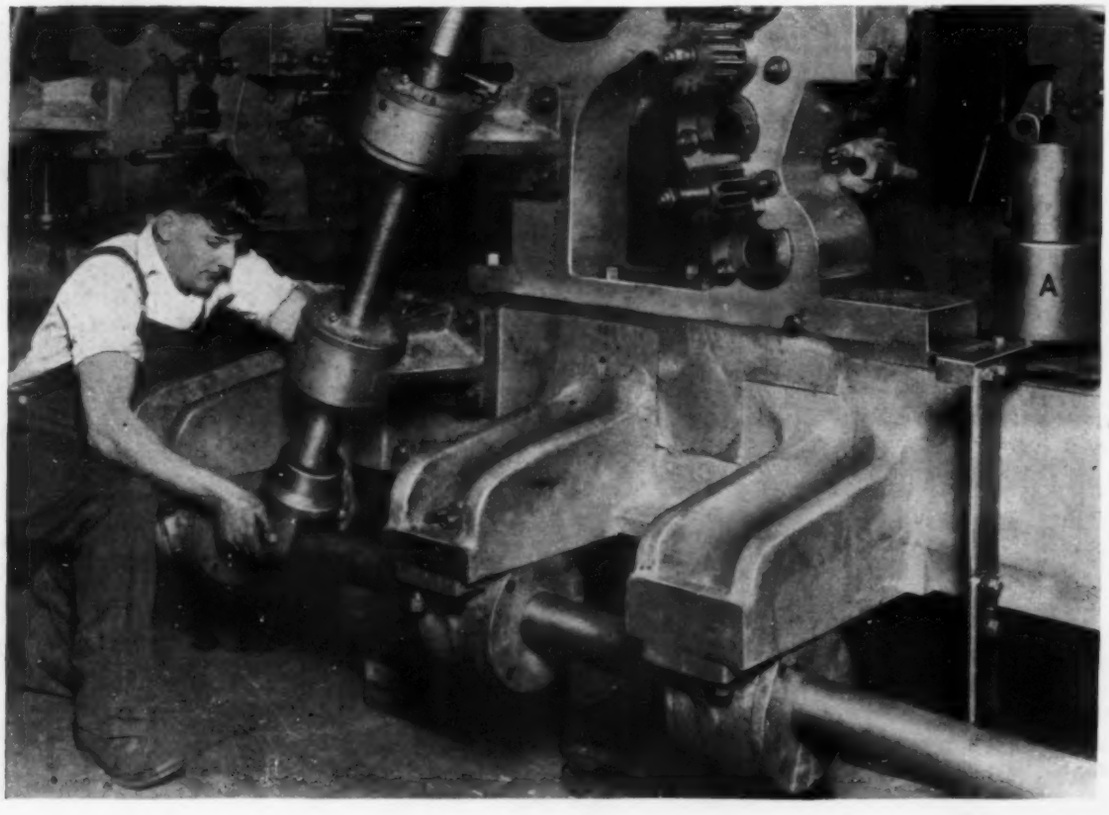
and has an adjustable measuring anvil on the lower end. A dial indicator is mounted as in Fig. 9 and positioned by the cross strip that contacts with the lining strip on the frame. It is then easy to check the squareness of the bearing by swinging the arm to the opposite angle, which gives two points approximately 10 ft. apart. Tension wires are also used in cross checking, as shown.

Aligning gear shafts to secure proper meshing of teeth has been greatly simplified by the method shown in Fig. 10. Standard shafts are used, these carrying enlarged ends that are centrally slotted to the size of the mating shaft. With these shaft ends in place, as at *A, B, C, D, E* and *H* it is easy to detect any misalignment that would affect gear action. The level at *J*, held on the shaft by the U-bolt shown, checks the squareness of the shafts with each other. The pointer *K* swings on the shaft and checks the distance to the face of the bearing.

Another example of the use of the slotted collar for aligning shafts is seen in Fig. 11, these shafts being at a decided angle. The angular brackets that carry the shaft bearings are good examples of the advantages of jig drilled parts, these being formerly drilled and bored in position on the frame. It will also be noted that these brackets have no caps, the antifriction bearing being pressed in place in the newer designs. Hollow headed cap screws are also used, as can be seen. The advantage of the new method can be seen by contrast with the old way of using a square, held on the bedplate as shown at *A*. After this was lined against the planed edge by the strip shown, the distance between the blade of the square and the shaft was used to check the shaft location.

When a unit is completed it is run in. Power is supplied by a portable motor that is held in position by braces between the motor and the press unit.

On one large press, the first one to be erected after jig drilled parts were fully obtainable, the time for erection was cut to less than three weeks. The time required



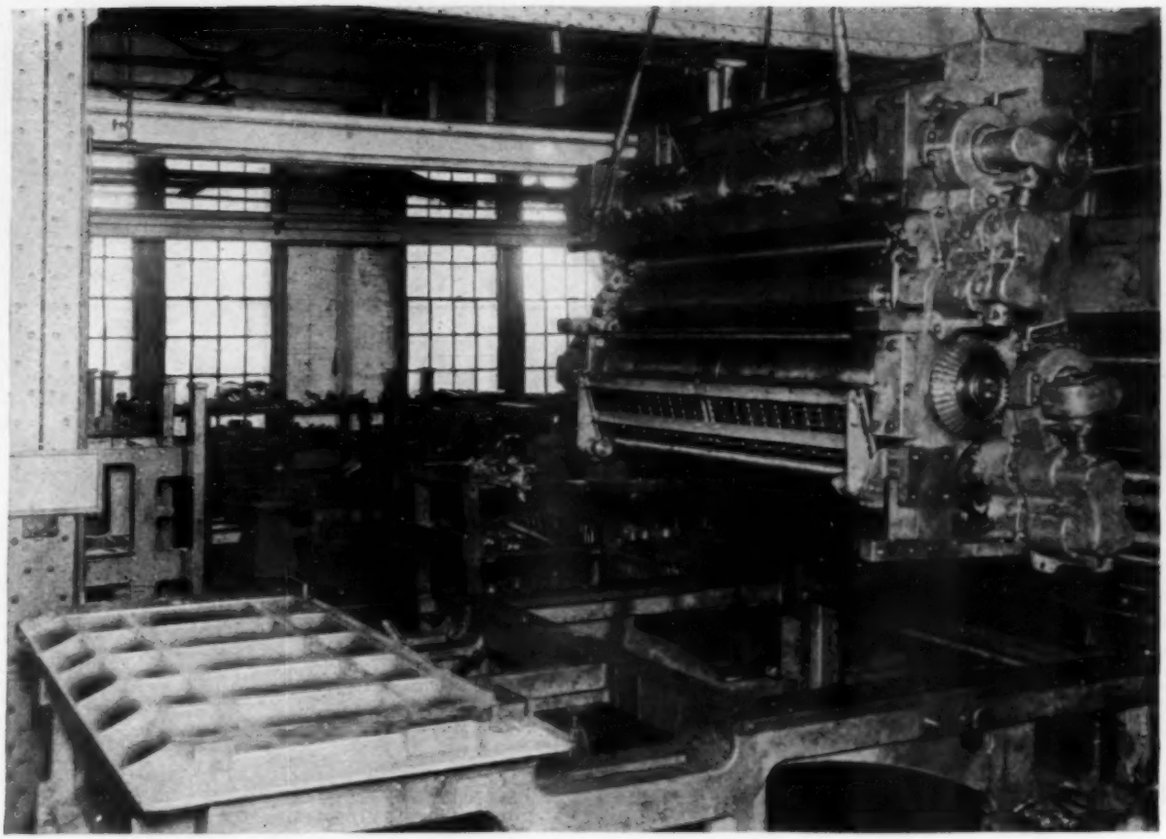


Fig. 12—Accuracy of alignment is maintained during shipment by special jig drilled bedplates

to erect one of the old presses of a similar capacity was something over three months.

Unit design has not been entirely confined to the various parts of the press itself but extends to special bases for shipping these units, as in Fig. 12, and to rails of I-section on which sub-assemblies are mounted as they are put together and on which they remain until they form part of the completed machine in the customer's plant. The press unit shown has just been unbolted from the main base plate, and is being transferred to the special base plate at the left. The holes in this plate have been drilled with the same jigs as the bedplates so that it is easy to bolt the unit in place ready for shipment.

These press units, as well as subassemblies, are now shipped intact, delivered to the customer's plant, and so installed. This has reduced the cost of dismantling, boxing, shipping and reassembling, as well as assuring the customer of a factory built, inspected, and adjusted machine.

■

Machine Tool Proving Grounds

J. C. P. BODE

It would be worth a great deal to any machine tool builder to know definitely, and to have a way of proving to his prospect, that his new creation has no bugs in it. Why not follow the lead of the automotive industry? Why not adapt some of their methods to machine tool building, just as we design our machines to suit their requirements?

It seems strange that the machine tool builder, having studied the needs of the automotive field closely enough to design some of its most efficient tools, should yet fail to adopt more of the successful methods of that industry. One of the difficulties the machine tool manufacturer, especially one producing the most accurate machines, has to contend with, is that of testing out thoroughly his new product before the first machine leaves the factory.

Putting a new machine into the experimental department may bring out the need of additional refinements; the best feeds and speeds may be discovered. A thorough scientific test is made; everything is found out, except whether the machine will stand the gaff and whether it is sufficiently foolproof.

An experimental engineer is as tender as a mother so far as machinery is concerned. He is accustomed to use his head and to fix things; so he will take care of a lot of fine adjustments and eliminate troubles without giving them a thought. He will not think of mentioning some of these in his report, because to a man of his resourcefulness, they will seem entirely too trivial. What every machine tool builder needs is a proving ground after the experimental engineer is through with his tests and reports. Granted, we can learn most by putting a few machines into the shops of friendly customers, but there are many obvious reasons why this is not always advisable, especially in a highly competitive field. Furthermore, this should not be done until every conceivable test has been made at home.

I mean a real test—to turn the first machine over to the greenest apprentice boy, someone from the shipping department, or any other man inexperienced in handling machine tools. Secure a batch of representative work, and with only the most necessary instructions about the operation of the machine, let him go to it. See if he will wreck it.

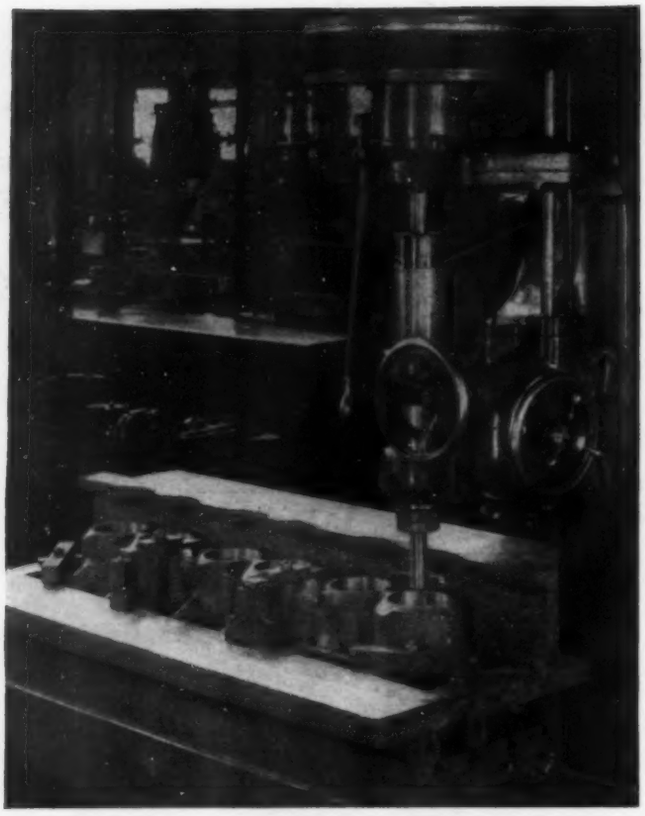


Fig. 1—The jig borer demonstrates its versatility on this boring bar guide for tractor engines

Jig Borers on Production Jobs

Formerly the jig borer was considered to have its sole use in the toolroom. Recent developments have proved it suitable for a wide range of work

IT SEEMS a bit incongruous to design and build a machine for making accurate jigs and have it work out in practice to be a production machine that makes jigs unnecessary. And yet this is exactly what has happened to the Pratt & Whitney jig borer, especially for applications where parts are not needed in large quantities. For, as nearly as can be checked, the majority of the machines built are not used for making jigs, but for the miscellaneous boring of holes where accuracy of diameter, and particularly of spacing, is of prime importance. Instead of being strictly a toolroom machine, as might be supposed, jig borers are found scattered throughout the shop, singly or in groups, where parts are to be bored uniformily in small- or moderate-sized lots. It is something of a shock to find machines that will bore and space accurately to a "tenth" used as glorified drill presses, but users insist that they earn good dividends in this sort of work.

This development does not mean that jigs are no longer necessary or that jig borers have abandoned that field. Where conditions make it advisable, the drill or boring jig is likely to hold its own, but the jig borer is no longer confined to the toolroom. Many shops, that would have hard work keeping a jig borer busy on jigs alone, even in good times, can use one or more for jig work, when jigs are to be made, and on production, when they might otherwise stand idle. The accompanying illustrations exemplify the use of jig borers on production work.

The job in Fig. 1 shows a jig borer, helping to build a machine for boring a six-cylinder tractor engine block. The part shown is the guide for the six boring bars, in which the holes must be accurate as to size, correct as to spacing, and also properly positioned in the head that supports the bar guides.

Four examples of fairly large hole spacing jobs are shown in Figs. 2 to 5. The first, Fig. 2, is a 53-in. disk, in which a large number of holes of different sizes had to be drilled and bored to small tolerances, both as to location and diameter. The spacing was then checked, as shown, by using the measuring devices on the machine, saving time over bench checking.

A large geared disk, for a dial feed mechanism, is being bored in Fig. 3. The spacing is secured by the rotary table while the outer edge of the disk is supported by an angle plate below the spindle. The thirteen $4\frac{5}{8}$-in. holes, shown in Fig. 4, are bored in a heavy disk and meant the removal of 300 lb. of metal. The disk is 48 in. in diameter and weighs 1,100 lb. in the rough. The accumulated spacing error was under 0.0003 in., and the boring time less than half that previously taken by other methods. A really large ring is shown in Fig. 5, with the operator standing inside it. It is positioned by two ground cylinders on the table inside the ring, and held by suitable clamps. The holes are located by the usual measuring methods of the machine.

Two plates, that are to form part of a machine assembly and that must match as exactly as possible, are being bored in Fig. 6. This is a simple production job, which a man familiar with the jig borer can set up and bore in far less time than by other methods. In this case, the quantity did not warrant the making of a jig. There are, of course, instances where it has been felt necessary to make jigs even for comparatively small quantities, and the jig borer is making a place for itself in this field.

An example of a strictly commercial job, for which jigs would have unquestionably been made a few years ago, is seen in Fig. 7. It is part of a standard punch and die set that is made in fairly large quantities. But the makers consider it better practice, both as to machining cost and accuracy, to use a jig borer on this work. By using the regular measuring methods with standard blocks, the settings are quickly made, and the holes accurately located, both with reference to the shank and to each other.

There has been about as much misconception as to the

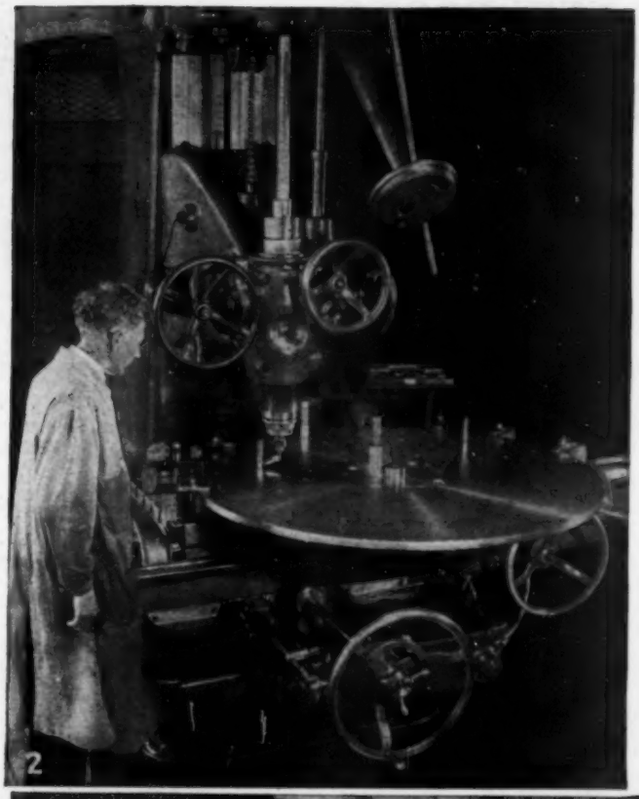


Fig. 2—By checking its own work, the jig borer eliminates the need of tedious bench inspection

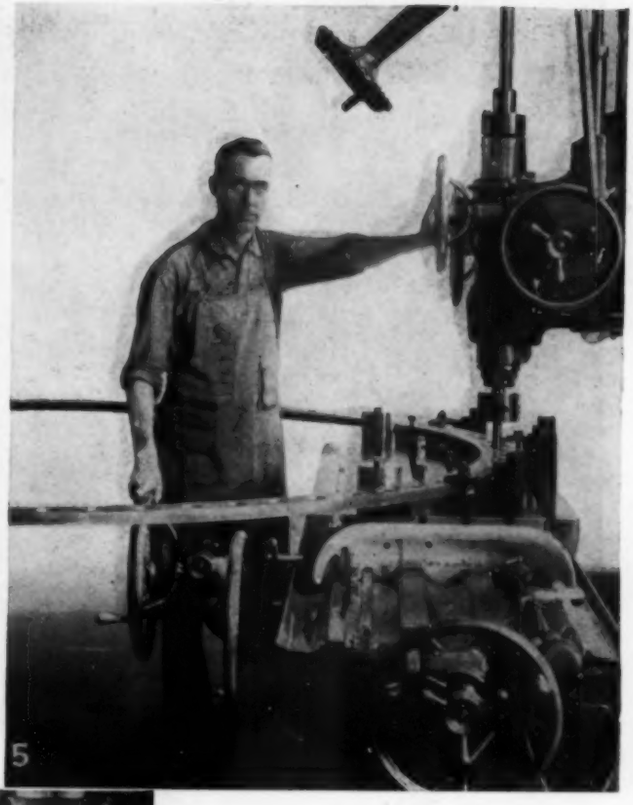


Fig. 3—The rotary table provides a means for accurate hole location on this large feed dial

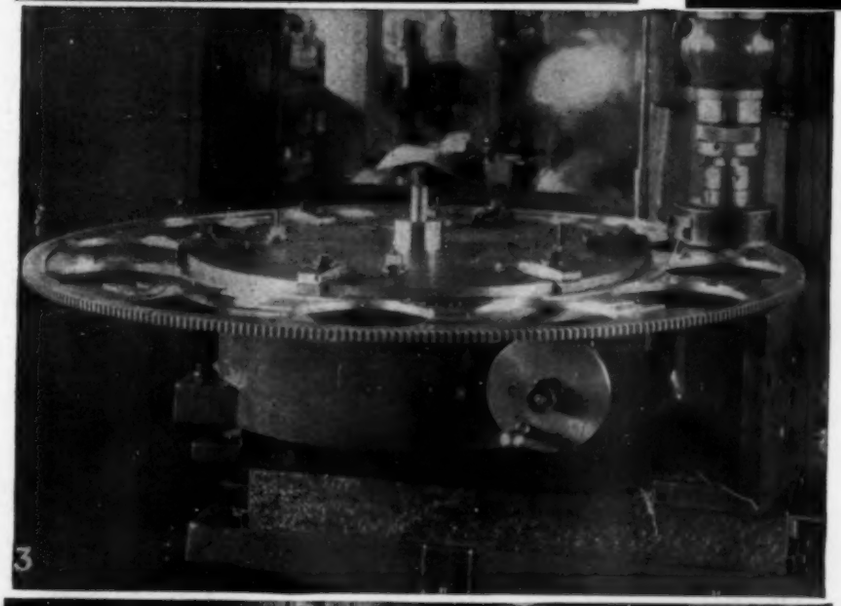


Fig. 4—The machine is not limited to light work. This job consists in boring thirteen 4¾ in. holes in a half-ton disk

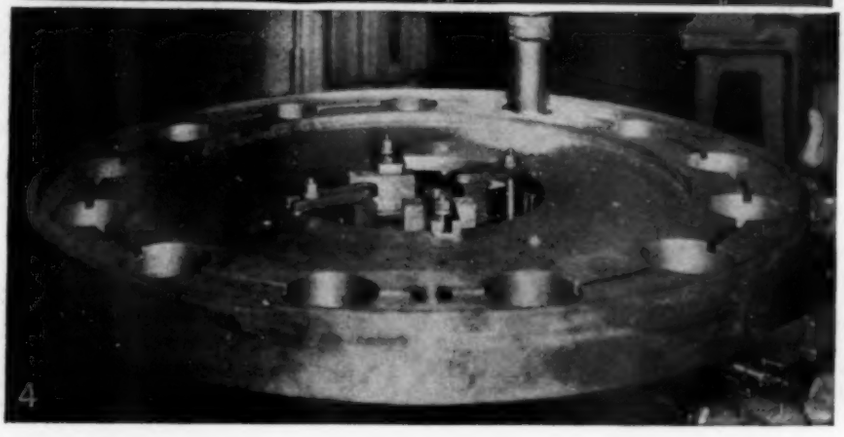


Fig. 5—Work of inconvenient proportions may be accommodated, as illustrated by the boring of this 9-ft. ring

kind of men required to operate such a machine as to the work it can do. For toolmakers are no more necessary than that the machine should be confined to jigs and tools. Such a machine should not, of course, be turned over to an untrained husky any more than a good milling machine or grinder. But handy men of all ages, with an aptitude for good work, soon become interested in the possibilities of the jig borer and do well with it.

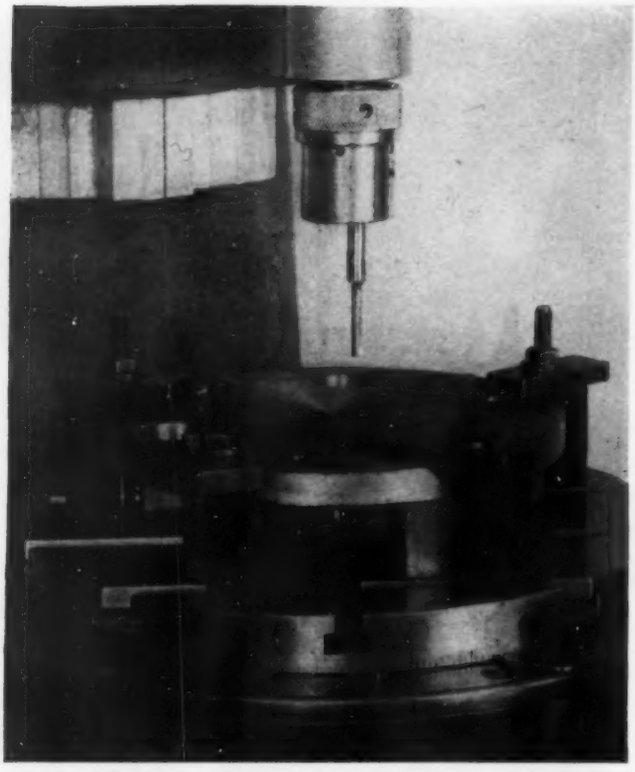


Fig. 6—The boring of two plates simultaneously provides another instance, where machining directly by the jig borer has replaced the use of jigs

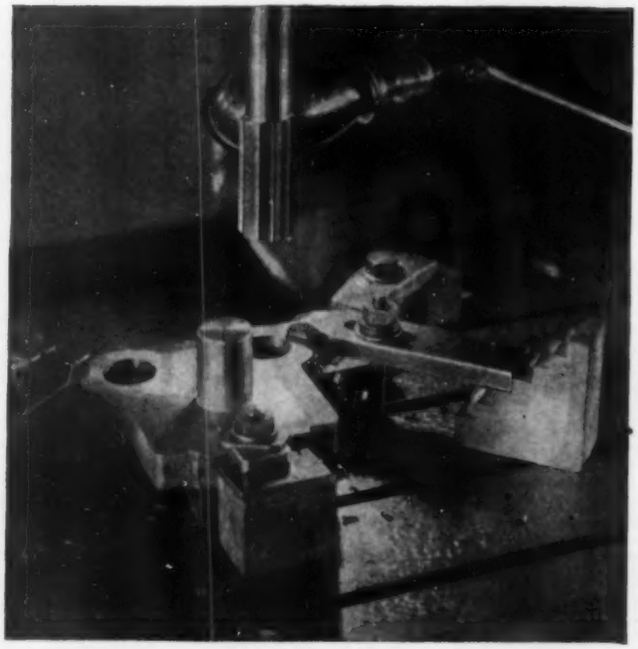


Fig. 7—Even where the quantities are fairly large, as for this standard punch holder, the jig borer has proven its efficiency

It is a particularly good job for men who are a bit beyond the age for the rapid production line.

In all jig borer work, and especially outside of the toolroom, the drawings should be so dimensioned as to be easily obtained by the two movements of the work table. When this is done the settings can be made rapidly.

NEW BOOKS . . . . . .

SHOP MATHEMATICS: PART I, SHOP ARITHMETIC (*Third Edition*)—*By Earle B. Norris, Director of Engineering, Virginia Polytechnic Institute, and Kenneth G. Smith, Michigan State Supervisor of Industrial Education. 271 pages, 6 x 9 in. Indexed. Illustrated. Clothboard covers. Published by the McGraw-Hill Book Co., 330 West 42nd St., New York, N. Y. Price $2.00.*

The third revision of this standard text incorporates certain minor changes suggested by classroom users and those made necessary by recent industrial developments. The majority of the work was, however, so carefully conceived and worked out by the authors that only minor adjustments have been necessary during the past eighteen years. Prepared while the authors were members of the Extension Division of the University of Wisconsin, subsequent revision has been handled by members of the Division. The whole is presented in interesting and readable fashion, avoiding where possible pedagogic language.

SCIENCE IN ACTION. *By Edward R. Weidlein and William A. Hamor, Mellon Institute of Research. 310 pages, 6x9 in. Indexed. 32 illustrations. Clothboard covers. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, N. Y. Price $3.00.*

Lectures and articles by members of the Mellon Institute over a period of the past 15 years form the basis for this sketch of the Value of Scientific research in American industries. The Institute's efforts to popularize and explain scientific development have here been unified to form an interesting and readable story of the growth and development of industrial research in this country. Most of the prominent laboratories and workers in applied science are mentioned, as well as their methods and results. Suggestions are offered regarding the organization and direction of industrial research, including the selection of laboratory personnel. Further, the book describes the rise, influence, philosophy, spirit and status of scientific research of all types. A veritable symposium of developmental data on industrial laboratories, it should prove a source of ideas to those who wish to prepare for scientific careers in industry and applied science, as well as a source of suggestions to those who wish to improve their plant operations or commercial practices.

EXAMPLES IN PLANE TRIGONOMETRY.—*By Winfield M. Sides, Department of Mathematics, Phillips Academy. 79 pages, 5x7½ in. Clothboard covers. Published by the McGraw-Hill Book Co., Inc., 330 West 42nd St., New York, N. Y. Price $0.70.*

As its title indicates, this is simply a supplementary collection of 680 trigonometric problems for the use of the instructor who believes that the problems listed in standard texts should be supported by a greater field of choice. Examples are included under eight headings and are graded as to difficulty. Standard solutions are provided to satisfy the usual drill requirements, while many new and difficult types have been introduced for special assignment.

Ideas from PRACTICAL MEN

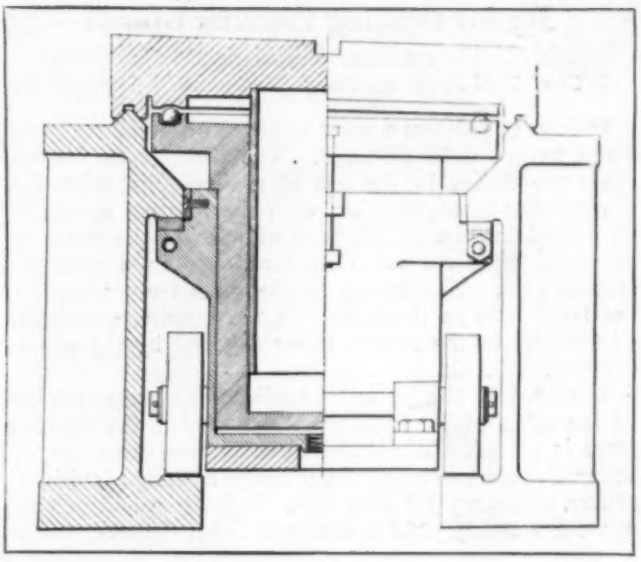
Centering Table Operated by Air Pressure

J. P. HARBESON
Camden Forge Company

Present-day operations in a heavy forge shop doing jobbing work require something more than a standard centering machine. For centering work ranging from short pins to driving axles for locomotives, a versatile machine is not only desirable but necessary.

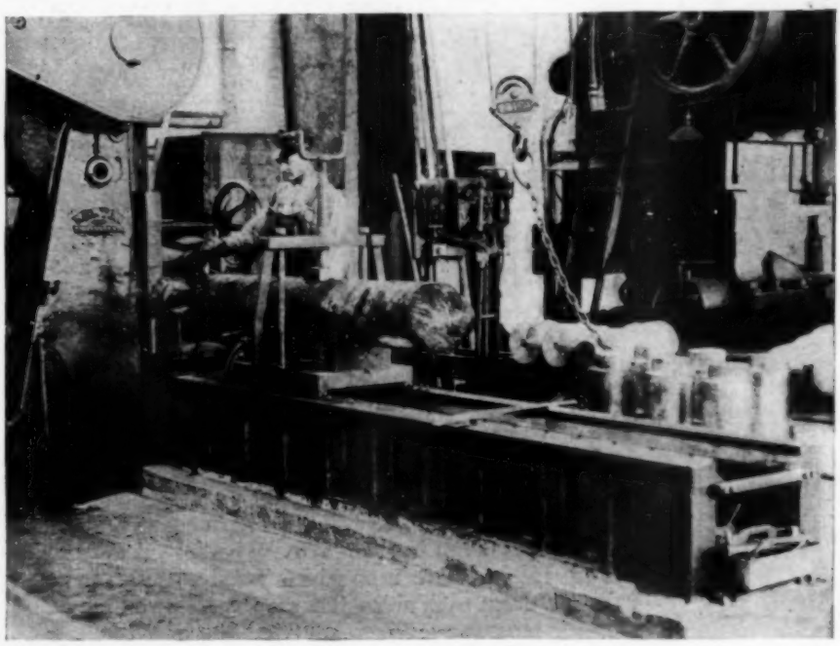
In our plant, we have adapted a standard 2½-in. horizontal drilling machine to the work of centering. While the machine has both vertical and horizontal adjustments for the spindle, its flexibility lies in the work-holding table. The table is mounted on a truck and has both vertical and rotary movements.

A 10-ft. cast-iron bed, as shown in Fig. 1, is set parallel with the drill spindle and is provided with flat tracks on the inside near the bottom, and inverted V-tracks at the top, as can be seen in Fig. 2. A small truck, having wheels equipped with roller bearings, runs



on the inner and lower track and carries an air cylinder. The piston, fitting the cylinder, is hollow, and fitting therein is a sleeve, the upper end of which is attached to the under side of the table, acting as a pivot. When air is admitted to the cylinder, the piston is raised and contacts with the table through a set of balls in its flange. Further upward movement of the piston raises the table from the V-tracks, permitting it to be easily rotated.

The work to be centered is laid in V-blocks mounted on the table and is held by a yoke clamp, the legs of which are hooked under the flange at the top of the bed. After one end of the work, has been centered, the clamp is released, and air is admitted to the cylinder, raising the piston and with it the table clear of the V-tracks and permitting it to rest on the balls. The table is then rotated 180 deg., turning the work end for end and presenting the uncentered end to the drill. The air is then exhausted, lowering the table to the V-tracks, and the work and the table are firmly held in position by the yoke clamp.



The wheels at the bottom of the truck permit it to be moved toward or away from the drill, the distance being governed by the clearance required for rotating the work. The longitudinal movement of the truck can take place only when the table is raised from the V-tracks, because when it is lowered onto the tracks it rests solidly upon them.

The four gibs shown provide adjustment for wear and thus forestall any looseness which might cause chatter when the machine is in operation on heavy work.

It will be seen that this arrangement has the advantage of permitting heavy forgings to be moved both longitudinally and angularly with ease. At the same time clamping is positive which gives the rigidity desired during the cut.

Jig for Drilling Packing Glands

CHARLES C. TOMNEY
Chief Tool Designer, Brunswick-Kroeschell Company

In Fig. 1 is shown a packing gland of which we make about twelve different sizes. . The three holes for the studs are drilled by the use of a simple jig, of which the bushing plate, together with the locating device, is illustrated in Fig. 2. Instead of spacing the holes by indexing, all three are drilled at once in a multiple-spindle drill. The bodies of the glands are placed in the large hole in the center of the bushing plate, one of the ears in the flanges being engaged by the screw-operated V-block.

The base of the jig is a simple bridge plate attached to the table of the drill press, on which the bushing plate is placed. While the same base is used for all the twelve sizes of glands, a separate bushing plate is, of course, necessary for each size. In loading and unloading, the bushing plate is removed from the base and is turned bottom upward. After loading, it is placed so that the work rests on the base. While I do not claim that this jig is cheaper to make than an ordinary plate jig, it is cheaper than a jig of the box type.

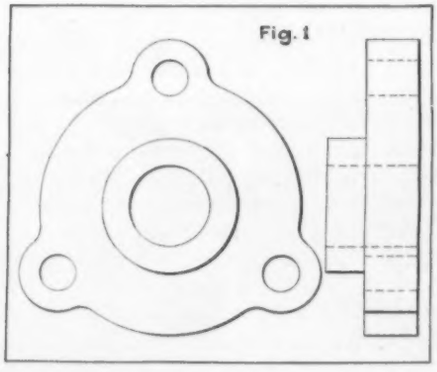


Fig. 1

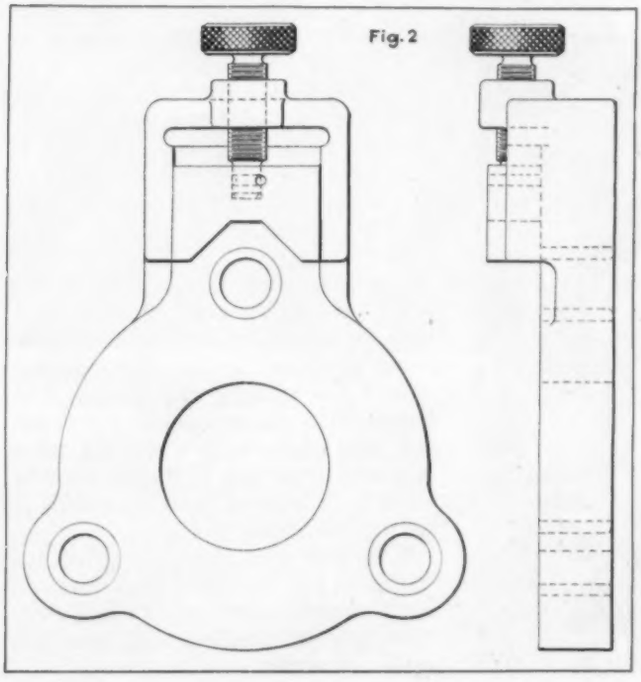


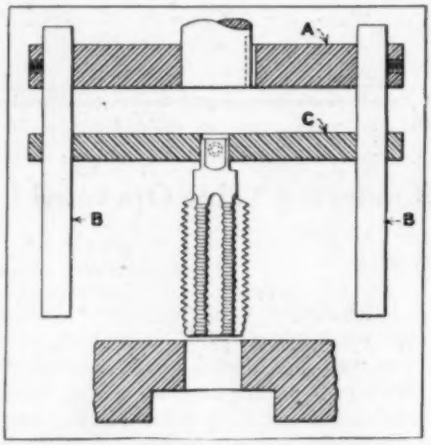
Fig. 2

A Tap Driver for the Drill Press

HAROLD F. KARRENBAUER

Having many large holes to tap, we made the device illustrated for doing the work in the drill press. The round plate *A* is bored to fit the outside of the machine spindle and is keyed thereon. Diametrically opposite in the plate are the two rods *B*, being adjustable vertically and held in position by setscrews. The tap holder *C* has clearance holes for the rods by which it is driven. It also has a square hole to fit the square on the shank of the tap.

In operation, as the tap is screwed in or out of the hole, the tap holder slides up or down the rods. In starting the tap the spindle is lowered, bringing the upper plate into contact with the tap holder. Continued downward pressure on the spindle forces the chamfered end of the tap into the hole. After the first few threads have "caught" in the hole, the tap automatically feeds itself, so that all pressure on the spindle can be discontinued. The clearance between the top holder holes and the guide rods allows a desirable amount of float.



Threading in a Radial Drill—*Discussion*

DONALD RAEBURN
Glasgow, Scotland

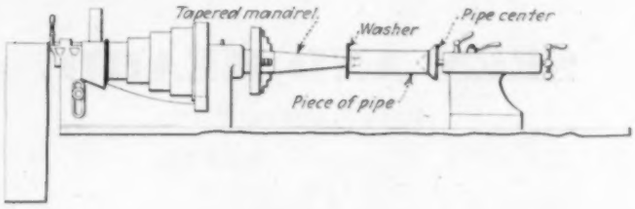
In an article under the title given above (*AM*—Vol. 75, page 284), J. T. Towlson gives an instructive criticism of the article by Ed. C. Rendler (*AM*—Vol. 74, page 731). Mr. Towlson describes his method of doing the work, also the construction of the tools required. The point he emphasizes is the ability to perform the operation on a machine tool with less driving power than that usually employed. The use of the threading tool and the bar made this possible, as the tap had only to perform its proper duty as a finishing tool.

Where a powerful drive is available, and the material to be threaded is not too hard, large blind holes can be tapped. A method that can be employed is that the first tap to be used is $\frac{1}{8}$ in. less in diameter than the finished size of the threaded hole. Assuming that the work is to be tapped 3-in. diameter Whitworth standard thread, $3\frac{1}{2}$ threads per in., the hole is drilled or bored 2.655 in., an allowance of approximately 0.020 in. less than the correct tapping size. After recessing the hole, the first tap used is a $2\frac{7}{8}$ in., five-fluted intermediate tap. This tap removes 0.110 in. on a side. The second tap used is a 3-in. intermediate tap, which removes approximately 0.065 in. from each side. This tap is followed by a 3-in. plug, or bottoming, tap to complete the operation.

A Special Lathe Mandrel

JOHN J. PHILLIPS, JR.

Some time ago, I needed washers for a counterbore job. None were available of the proper outside diameter, so it was necessary to cut one down. I had no mandrel to hold the washer, so I chucked a piece and tapered it



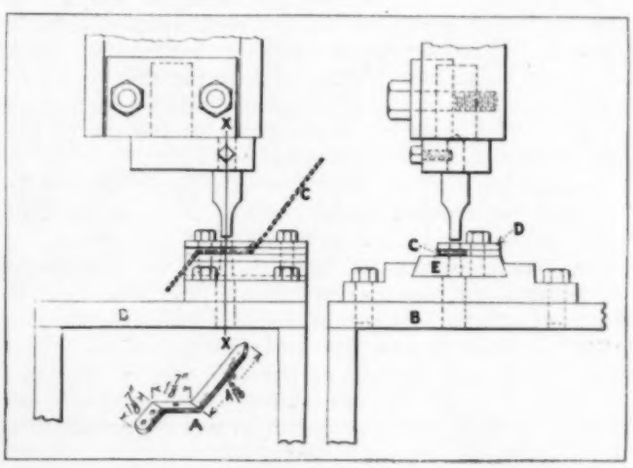
from ¼ in. to 1 in., making the taper about 3 in. long. I then put the pipe center in the tailstock and, by putting a short piece of pipe between the pipe center and the washer on the mandrel, as shown in the drawing, I found I could hold the washer rigidly while cutting. Later, I took a piece of toolsteel and turned it down to fit the taper in the headstock and fluted the taper in order to get a better grip on the washer. Now, any time I want to cut down a washer with a hole anywhere between ¼ and 1 in., all I have to do is remove the center from the headstock and insert the mandrel. For smaller washers, I use a smaller piece of pipe.

An Inverted Punch and Die—*Discussion*

GEORGE D. TAYLOR

At the conclusion of the article under the title given above (*AM*—Vol. 74, page 914), Charles H. Willey says he wishes to know how others would handle the job described. Since Mr. Willey has given but two dimensions, the thickness of the stock and the diameter of the hole, I applied a scale to the dotted outline of the hole in the die, and it measured about ⅛ in. in diameter. From this measurement I assumed that the parts shown were about one-third actual size.

In the accompanying illustration is shown how I would make the tools for the job, assuming the dimensions of the piece to be about as shown at *A*. If necessary, a hole could be made in the bolster *B* to allow the short leg of the piece to pass through. In this case, the short leg could be as long as 8 in., while the ceiling would be the limit for the long leg.

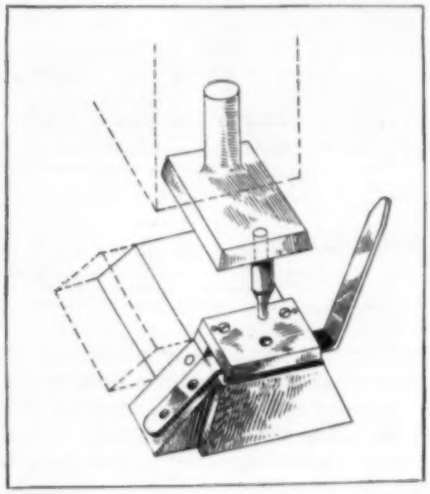


The work *C* could be located by the right-hand edge of the slot in the stripper *D*, or, if necessary, by the left-hand edge of the die *E*. At the left in the illustration is a front view of the press bed, the ram, and the tools, the line *X*-*X* being the center line of the tools, while at the right is a side view of the same members. In both views the ram is shown at the bottom of its stroke but at the top of its 1½-in. adjustment.

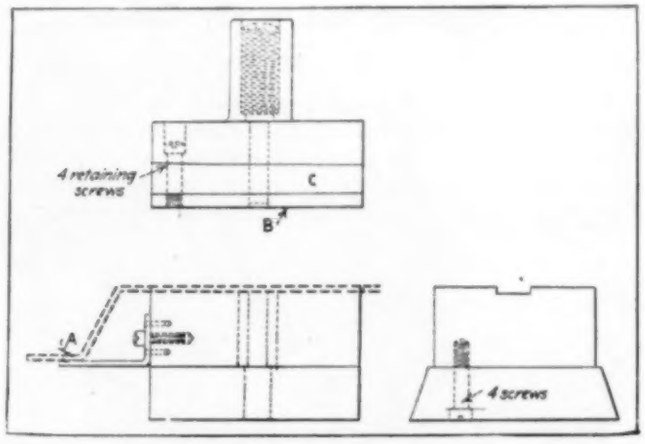
A. DANA SEEDS

Model Room, Corbin Cabinet Lock Company

For the life of me, I cannot see why an ordinary die-block, or dieshoe as they call it in Massachusetts and points North, would not do for the job. If the shorter leg of the work would go between the punch and the die, as per Mr. Willey's illustration, why could he not have put in the work crosswise of the die, as shown in the accompanying illustration. Of course, the punch-holder would be offset so that the long leg of the work would clear the ram. By this arrangement, the handling of the work would be easy.



I would like to take this opportunity to compliment Mr. Willey on his sketches, and to say that criticism of any article of mine will be gladly received, as I hope this will be by him.



CHARLES F. KRAUT

I would not invert the tools, but would make them as shown in the illustration. The work would be placed in a groove in the die-block, the gage pin *A* engaging one of the holes previously punched in the short leg. The stripper plate *B* would be held to the punch-holder

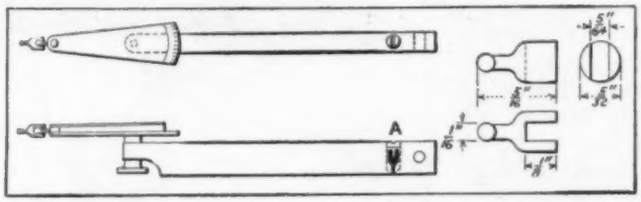
by four screws and would be backed by the block of rubber *C*.

In operation, as the ram descends, the stripper plate will contact with the work, holding it firmly. As the rubber is compressed, the punch will be permitted to do its work. After the hole has been pierced, the return stroke of the ram will relieve the pressure on the rubber, permitting it to expand and force the stripper plate downward. By this means, the work will be automatically stripped from the punch, leaving it flat. By the use of the inexpensive tools described, the work can be handled quickly.

A Detachable Indicator Point

THEODORE KRUGER
Diamond Machine Company

In using Ideal indicators in various shops, many machinists and toolmakers have fitted them with smaller points to enable them to be used in small holes and slots. In some cases, the additional points were soldered to the



regular points, and in others the regular points were reduced in size, sometimes ruining the indicator.

I designed the detachable point shown enlarged in the illustration for my indicator. When not in use, it is housed in a hole drilled in the shank of the holder and is held in place by a headless screw, as at *A*. The auxiliary point is satisfactory in use. Tool- and diemakers should be interested in its features and in the simple method of storing it.

Corrugating with a Fly Cutter

FRANK C. HUDSON

A few corrugated metal steps were needed in the Roanoke shop of the Norfolk & Western Railway when none of the regular non-slip plates were available. The plates were about $\frac{5}{16}$ in. thick and perhaps 9 in. wide. They were made by taking a fly cutter of approximately a V-form and mounting it to have a radius of perhaps 10 in. The cutter was put in a vertical miller with the

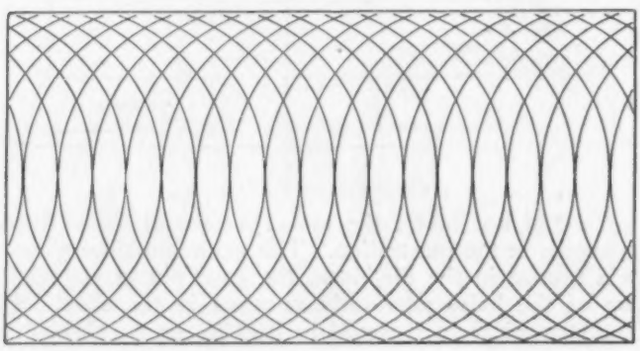


plate held flat on the table which was given a $\frac{3}{4}$-in. feed per revolution of the cutter.

While the curves cut in the plate were not true arcs of a circle, as shown in the illustration, the distortion was not noticeable and did not matter in any case. This method gave the desired steps without delay and answered the purpose perfectly.

SEEN AND HEARD

JOHN R. GODFREY

Ford's First Engine

I've just unearthed an old clipping regarding the first automobile in this country, the controversy seeming to hinge on Haynes, Duryea and Ford, while the dates vary from 1893 to 1896. The interesting point is that the statement is made that Ford made his engine from drawings in the *American Machinist* and this was attested by witnesses in the celebrated Selden suit, which Ford won.

Making Steel Floors Safe

Steel plates save wooden floors from wear by material handling trucks, but they also introduce a distinct accident hazard that is not to be overlooked. This is particularly true in screw machine and other departments where cutting oil scatters itself rather promiscuously. One shop, recently visited, was experimenting with various coatings for the steel floor plates to reduce or remove the slipperiness. Silicate of soda mixed with abrasive and metal dust from grinding wheels worked fairly well but soon wore off. Who has a better solution?

Laying Out a Boring Bar

John A. Tansley believes that the younger machinists have lost some of the resourcefulness of the past generation. He describes the following example:

Old-time mechanics had to be resourceful and confident. Industries throw away annually, thousands of dollars that could be saved by most any old-time reliable mechanic. Just recently, I set up a small machine shop and got out the tooling for the product, which included several boring bars. These bars were slotted for tools on both sides. The man that got them out had been a foreman for several years in the repair shop of a high-powered production plant, making automobile parts. There was no surface or other plate in the shop on which to lay out the bars and no machine with a platen large enough. The man was stuck and came to me to ask how he could lay out the slots without a plate.

Imagine his surprise when a strip of paper about $\frac{1}{2}$ in. wide was put around the bar, lapped over, and cut just so the ends touched. The paper was folded in the center, one end being set to a line on the bar and the fold giving the location for the opposite line. This was done in about one quarter of the time it would have taken a man to lay out the work on a plate and provided means whereby he could easily lay out on the periphery of the shaft any angle he might desire. However, we must take off our hats to high-powered production and the accomplishments of the present machine age.

SHOP EQUIPMENT NEWS

Landis Type B 12x32-In. Tool and Cutter Grinder

Plain and universal Type B tool and cutter grinders have been developed by the Landis Tool Co., Waynesboro, Pa. In these 12x32-in. machines, the controls have been grouped for convenience of the operator and certain controls are duplicated at both the front and rear. The bed is of box-type construction, and a water reservoir is cast integral, making it a comparatively simple matter to apply a wet grinding attachment. Two motors are mounted within the bed while the third, that is, the workhead motor, is mounted on the workhead itself. Three snap switches mounted at the left-hand end of the bed give control of the motors.

The traverse motor is mounted within the bed at the right, and three traverse speeds are secured by shifting a flat leather belt. Water pump drive is also taken from this motor when the wet grinding attachment is supplied. The grinding wheel is driven by a motor mounted on the lower end of the column, and this motor is also protected from dirt and moisture. Reversing the two-step motor pulley gives a second grinding-wheel speed.

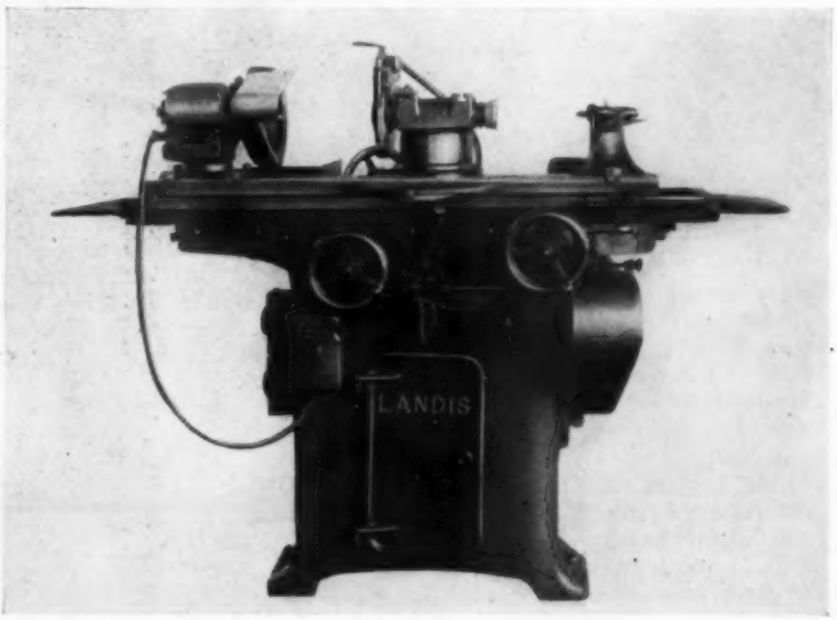
Wheel spindle bearings are duplex, preloaded ball bearings. The wheelhead may be swiveled 90 deg. in either direction, and a grinding wheel up to 8 in. is supplied as standard. The workhead may be swiveled in either a vertical or horizontal plane, or may be used for dead spindle or live spindle grinding. The workhead motor is mounted on a slotted plate to maintain proper tension on the drive. Work-table guide way construction makes possible table traverse with very little effort.

In addition to plain or universal equipment, certain special equipment can be had. For example, a multi-speed workhead and suitable footstock may be secured. Six work speeds are available with this heavier head, but only a constant-speed motor is employed. A surface grinding head may be added where a large amount of surface grinding is to be done. The weight of the plain machine, without electrical equipment, is 2325 lb., and of the universal machine, 2525 lb.

Bridgeport High-Speed Milling Attachment

A high-speed milling attachment for milling machines has been developed by The Bridgeport Pattern & Model Works, 50 Remer St., Bridgeport, Conn. It is of particular value in building dies for bakelite, hard rubber, glass, die casting or blanking and forming. It is also useful on model work. It is designed to swivel 360 deg. both ways, and is a self-contained power unit.

The spindle is hardened and ground and takes draw-in collets with a $\frac{7}{16}$ in. maximum capacity. The spindle is mounted on four SKF preloaded ball bearings, with the bearings on the pulley end floating in the housing to compensate for expansion or contraction of the spindle. The combined belt guard and motor bracket swivels completely around the spindle housing making it possible to tilt the head at any angle. Speeds of 500, 1,300, 2,500 and 5,000 r.p.m. are provided by 4-step V-grooved aluminum pulleys, driven by a molded V-belt.



The motor is of ¼ hp., and has a reversing switch mounted in an aluminum dust cover. The clamp is machined to suit the arm on the customer's milling machine.

"American" Small Series Flexible Coupling

Two small flexible couplings have been added to the line of the American Flexible Coupling Co., Erie, Pa. These couplings have maximum bores of ¾ in. and 1 in. and are designated as No. 4 and No. 6. In general design they are much the same as the larger couplings manufactured.

The flange sections are die-cast, and a wide groove is formed in the face to leave two jaws between which the

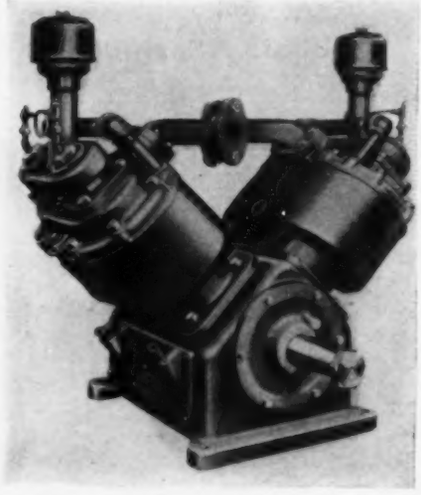
floating member slides. The floating center member is a solid, non-metallic, self-lubricating piece. Power capacity is 0.05 hp. per 100 r.p.m. for the No. 4, and 0.15 hp. per 100 r.p.m. for the No. 6. The weights are ¾ lb. and 2 lb. respectively. Both sizes permit a maximum parallel misalignment of $\frac{1}{64}$ in. and a maximum angular misalignment of 1 deg. It is not necessary to dismantle the coupling in order to disconnect the driving and driven shafts.

"Thor" No. 288 Rotary Pneumatic Wrench

A "Thor" No. 288 non-reversible rotary pneumatic wrench has been developed by the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill. This wrench will remove 1⅛-in. cylinder head bolts and all flexible staybolt caps. An auxiliary handle is provided for the operator's helper where the wrench is to be used in close quarters. Where space is unlimited, the wrench can be equipped with a right-angle head with a lug, providing for an extension dead handle in line with the throttle handle. The speed of this wrench is 160 r.p.m., the length overall is 41½ in., the spindle offset is 2⅛ in., the length of spindle is 9¾ in., and the weight is 48 lb.

Curtis Model C Compressors

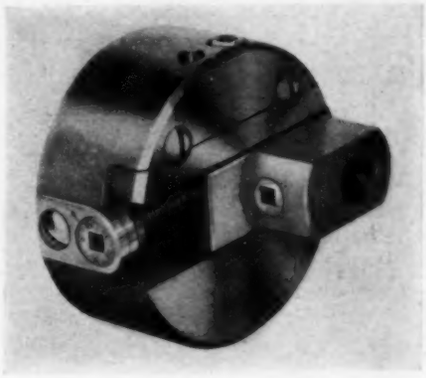
Model C Timken-bearing-equipped compressors for industrial purposes have been developed by the Curtis Pneumatic Machinery Co., St. Louis, Mo. The complete line consists of seven models, five of the two-cylinder type, ranging in size from 4¼x3¾ to 6½x5 in., with displacements of 25 to 125 cu.ft., and two of the four-cylinder type, a 5½x5¼ and a 6½x5¼ size, with displacements of 115 and 262 cu.ft., respectively. These compressors are furnished for belt drive



from a lineshaft, by means of a separate motor, or other prime mover, and can also be furnished as complete self-contained units, either direct connected or driven by a multiple V-belt. Among the construction features of these compressors are the carbon-free valves, the use of Timken bearings on the crankshaft and the Curtis "Centro-ring" oiling method.

Flynn No. 30 Micrometer Boring Head

Dovetail design is employed in the No. 30 Flynn micrometer boring head announced by J. M. Waterston, 427 Woodward Ave., Detroit, Mich. This design is particularly adapted for use

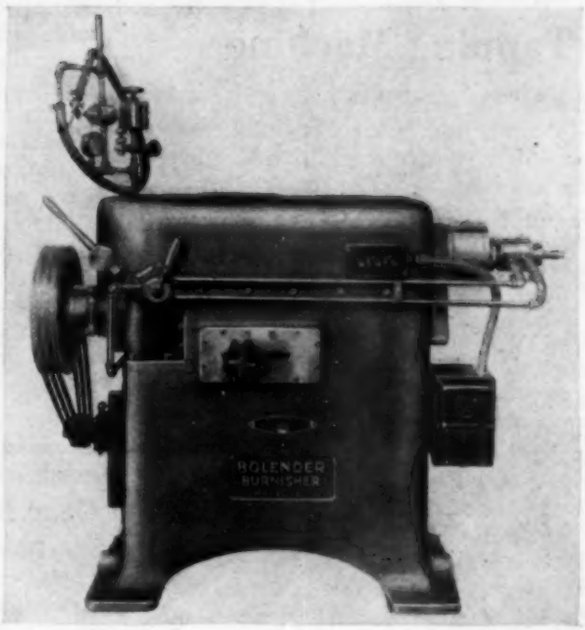


where a large offset is required, the capacity of this tool being 2½ in. The body is made of steel. It is equipped with a tension gib and locking device to take the strain from the micrometer screw. The dial is graduated in thousandths, fifty thousandths to a turn. Bar capacity is ¼ to ¾ in., body diameter 4½ in., body length, 1¾ in., and the weight, 8 lb.

Bolender No. 1 Semi-Automatic Burnishing Machine

A smaller No. 1 semi-automatic burnishing machine has been developed by the City Machine & Tool Works, East Third at June Sts., Dayton, Ohio. It is similar to the larger machine in that the burnishing pressure is exerted horizontally to the center of the master burnishers, the flat gear mounting avoids overhang, and a variable burnishing pressure may be secured.

The machine does not have a fully automatic burnishing cycle. The cycle is controlled by a three-button switch, which permits the operator to burnish the work in one direction, reverse and stop it, so ending the operation. Although this particular model is shown



The semi-automatic cycle of this smaller Bolender No. 1 Gear Burnishing Machine is controlled by a three-button switch

as air equipped, the machine may also be furnished with a hydraulic unit. A built-in coolant system and Timken bearings are standard equipment. The machine handles both spur and helical gears up to 8½ in. outside diameter.

Henry & Wright All-Steel Presses

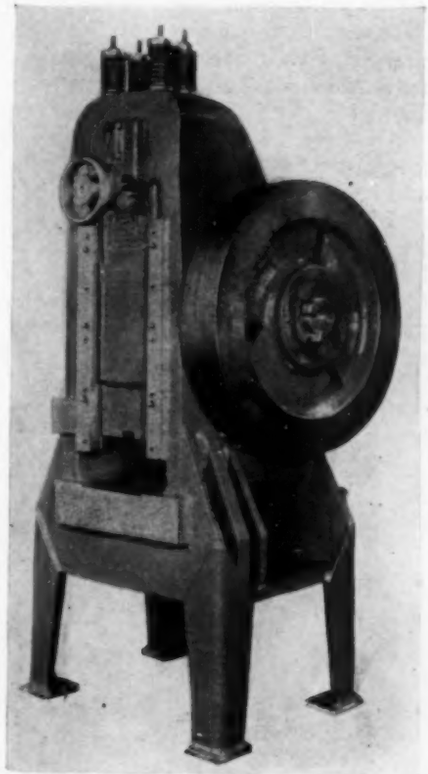


Fig. 1—Henry & Wright All-Steel Knuckle-Joint Press, which has a solid frame in order to minimize the right to left dimensions for the required die space. Guide ways are 50 per cent longer

Extensive additions have been made to the line of all-steel presses built by the Henry & Wright Mfg. Co., Hartford, Conn., and announced previously on p. 701, Vol. 74. In addition to the inclinable and single crank straight-sided types, the line now includes double-crank, straight-sided presses, horning types, straight-sided knuckle joint presses, double-crank overhanging gap-frame presses, as well as special presses of various types. Practically all of the single-crank, double-crank and knuckle-joint presses are made in the shrunk-in tie rod construction, although a number of these presses have been built with solid frames where special tooling or other conditions warranted. All welded units are made from steel plates of special welding quality.

The 200-ton knuckle-joint press illustrated in Fig. 1 is of the solid frame type in order to keep the right to left overall dimension to a minimum for the required die space. The slide and wedge block are also made from fabricated steel units to obtain maximum rigidity for intricate coining operation. Design of the slide and link mechanism is such that the length of the guide ways is approximately 50 per cent longer than is customary on a press of this capacity. This is secured without increasing the over-all height of the press.

The press has a ½-in. stroke and operates at 65 strokes per min. Wedge adjustment of the slide of ½ in. is provided. Continuous force-feed lubrication is supplied to the hardened and ground alloy steel pins and link linings. Finished pads are furnished on the frame so that the user can mount special feeds previously used on cast-iron-frame presses for this work.

The fixed inclined open-back press, shown in Fig. 2, is inclined 15 deg. from the horizontal and has an especially large bed area and opening. The machine is lighter in construction than cast-iron construction and an increase of over 30 per cent in die life has been obtained. This press is an example of the flexibility of welded steel design in providing a press to meet the special tool requirements of the customer.

The company is also furnishing welded steel frames for all types of presses to replace broken cast-iron frames. The steel frames are machined to use the shaft, slide and other parts of the old press.

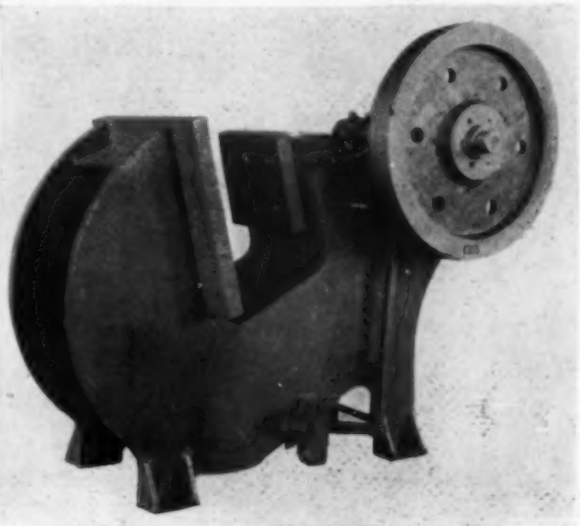
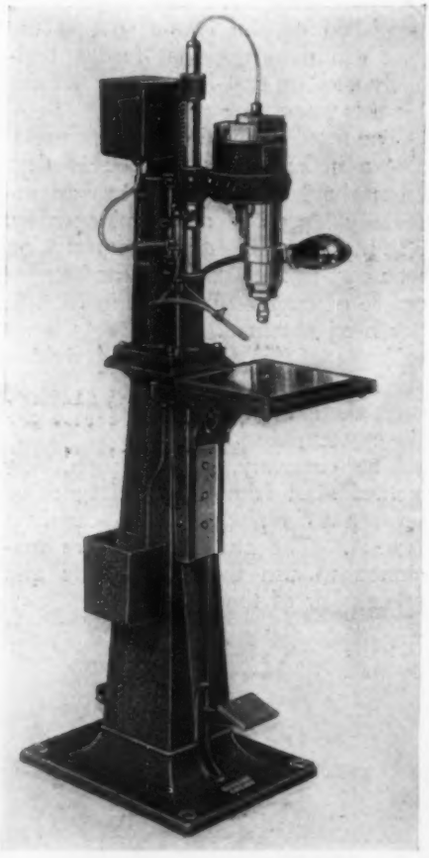


Fig. 2—Inclined 15 deg. from the horizontal, this fixed, inclined, open-back press gave 30 per cent more die life than would cast-iron construction

Haskins High-Speed Tapping Machine

A high-speed tapping machine in which tap breakage and stripped threads are practically eliminated is announced by R. G. Haskins Co., 4636 W. Fulton St., Chicago, Ill. Control is by a treadle so arranged that the load on the tap is definitely limited no matter how suddenly pressure is applied. The operator's hands are free for positioning the work. Tapping capacity is $\frac{1}{4}$ in. in brass and $\frac{3}{16}$ in. in steel.

The tapping head is a self-contained unit and incorporates a highly sensitive reversing mechanism operating at high speed. The tapping unit is readily removed from the machine and is entirely inclosed in a rigid two-piece aluminum housing. Ball bearings are used throughout except on the chromium-plated collet shaft, which operates in an amply lubricated hardened and lapped alloy steel bushing. The lubricant is retained in a felt-packed well, and oil is delivered to the bearing surfaces as required. An occasional replenishment of the oil is all that is necessary. The tap is held by a collet chuck that accurately centers it and drives it by the square shank. The chuck is small in diameter and light in weight to minimize the inertia effect. Collets are furnished to take taps from Nos. 2 to 14.



The machine is regularly furnished with change gears for any two of the following standard tapping speeds: 1,500, 1,750, 2,333 and 3,062 r.p.m. Special gears can be furnished for tapping speeds of 2,130, 2,676, 3,500 and 4,000 r.p.m. Reverse speed is twice that of the tapping speed. The gears can be quickly changed by loosening the wedge lock and removing the tapping unit from the motor housing.

Owing to the high speed of the taps, a suitable lubricant is necessary, even for cast iron, and to furnish this in the right amount and at the correct time and place, a plunger pump is supplied. This pump operates automatically, is simple in construction, dependable in action and is adjustably mounted on the left side of the machine frame. The amount of discharge can be regulated, and the nozzle can be quickly located to deliver lubricant at the point of tapping. A tank of ample capacity is provided for the supply of tapping compound.

The motor is of the repulsion-induction type, has ample power and operates at a moderate and constant speed. All bearings are high-grade combined radial and thrust ball types. The bearings, as well as the gears, are grease packed. A sturdy start and stop switch is incorporated in the front of the motor housing.

The tapping unit is held in a rigid split-ring arm secured to the ground, hollow vertical shaft which is connected with the treadle. The vertical shaft slides in two long bearings which are bored and lapped. The arm holding the tapping unit has vertical and side-to-side adjustment and is secured by a wedge lock. The tapping unit and other vertical moving parts are counterbalanced, giving the tapping unit a free-floating sensitive action. A suitable spring gives snappy return of the tapping head. On the right side of the frame is a set of adjustable stops for limiting and locating the vertical travel. An adjustable light attached to the frame furnishes illumination. A roomy table is adjustable vertically.

This machine can be furnished with a substantial cast-iron pedestal base mounting as shown or arranged for bench mounting. Production is limited only by the ability of the operator to present the holes to the tap, and the tapping operation itself is almost instantaneous. Suitable fixtures are also a factor. Finish is crystalline baked varnish, natural aluminum and nickel plate.

"Cleveland" Size 70 Worm Gear Reduction Unit

A Size 70 worm gear reduction unit to transmit up to about $7\frac{1}{2}$ hp. has been developed by the Cleveland Worm & Gear Co., 3258 East 80th St., Cleveland, Ohio. The unit is furnished in both horizontal and vertical types. The horizontal units are built with the worm below or above the gear, and are designated as Type AT or RT, respectively. In the Type VT vertical the gear shaft extends upward, and in the Type VD it extends downward. The Type AT is shown.

All shafts of this unit are mounted in anti-friction bearings. The worm and its shaft are made from a single nickel-alloy steel forging, and the gear is hobbed from a solid nickel-bronze blank. The worm thread is of the automotive type with a high-pressure angle. Oil seals are fitted on each shaft extenson. The nine standard ratios vary from 4 5/6:1 to 60:1, and fifteen special ratios are also available.

Wicaco Bevel-Pinion Burnishing Machine

All types of bevel pinions can be burnished on the machine recently announced by the Wicaco Machine Corp., 4801 Stenton Ave., Philadelphia, Pa. Three master gears are revolved in engagement with the pinion being burnished, the axes of the three masters and of the pinions intersecting at one point. The pinion is thus allowed to find its natural running position. One of the masters is belt-driven from a countershaft, and can be rotated in both directions. The other two master gears are mounted on spindles held within bronze micrometer sleeves and also conical eccentric sleeves. One of the eccentric sleeves has a hand lever by means of which the two master gears may be rolled about the common apex point. A uniform tooth pressure on all three master gears and the pinion is thus obtained and this pressure is in line with the common apex point of the four gears. This pressure tends to close the open pores of the metal and to produce hard, glazed surfaces on the tooth profiles of the pinion.

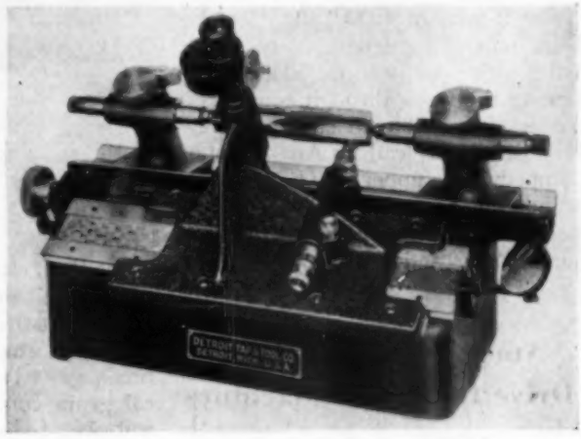
The driving master gear also has a micrometer adjustment sleeve. The other two heads are provided with flywheels at the rear. The three heads are assembled into a trunnion bracket, and they may be adjusted to the required angular positions to suit pinions of different gear ratios. By means of a gib each head has a horizontal movement on the base.

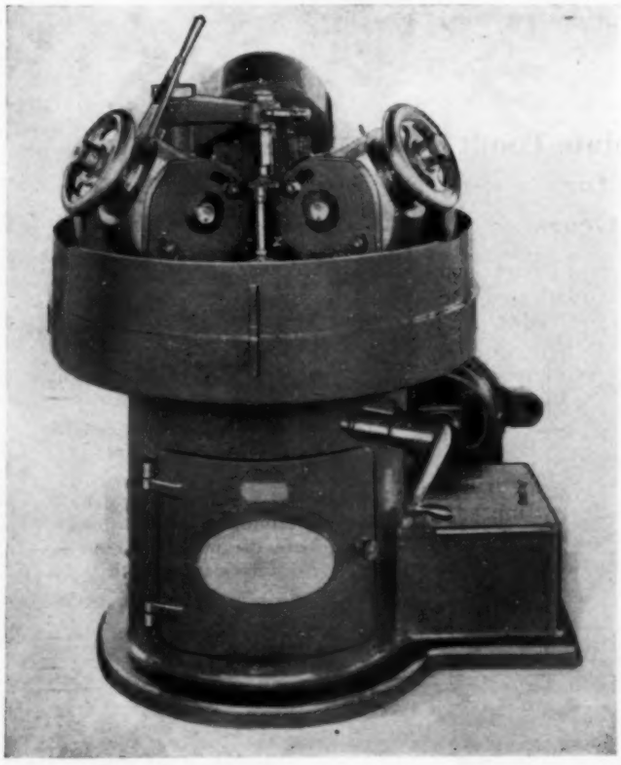
The overhead support arm is located on the vertical column, and is provided with a micrometer stop, against which the slight upward thrust of the pinion is taken. The thrust amounts to less than 2 per cent of the applied tooth pressure. Through a sleeve adapter, a fixed distance is established between the pinion shoulder and stop. Correct curvature of the pinion sleeve adapter assures a fixed back cone distance.

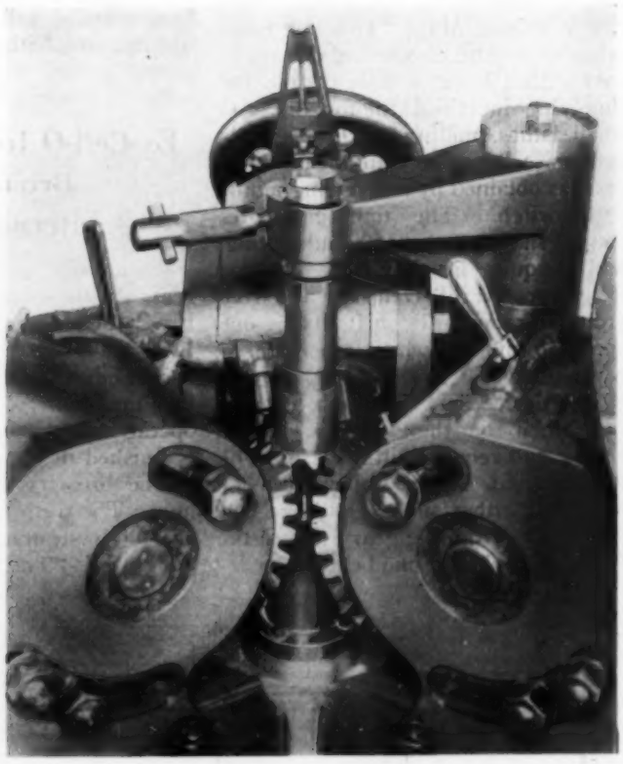
A pressure-fed system for delivering compound to the pinion is supplied. The base of the machine is adaptable for either motor or belt drive at any time.

"Detroit" Lead Testing Instrument

A combination of optical and mechanical means of measuring the lead of taps and other threaded work is employed in the lead testing instrument developed by the Detroit Tap & Tool Co., Detroit, Mich. Measurement is made by means of a spiral micrometer and microscope, supported on a carriage and focused on an optical scale. The carriage is fitted with a spring loaded plunger, carrying at its extremity a removable ball point, which engages two adjacent threads of the piece. This plunger







mechanically locates the carriage which moves on ball races, the position of the carriage being shown in the microscope.

The optical scale can be adjusted longitudinally by means of a screw at the left to bring any suitable graduation to coincide with the zero line in the ocular as a starting point. A light is transmitted through the scale by means of a mirror on the right of the instrument and a second mirror suspended from the carriage below the scale and in the optical axis of the microscope. The only operations required are to locate the plunger and to read the micrcosope. Maximum error does not exceed 0.00004 in. per in., or a total of 0.00018 in. for the 8 in. measuring length. An index plate, with four notches, adapted for turning the work through equal arcs, renders it possible to check a screw for drunken lead. An adapter, clamped to the upper way and capable of holding rectangular pieces, facilitates the checking of thread rolling dies, chasers and similar work.

Ames Two-Speed Gear Drive operated by treadles attached to an Ames bench lathe for an under bench drive

Ames Two-Speed Gear Drive for Bench Machines

A gear drive or two-speed reduction unit for bench machines has been announced by the B. C. Ames Co., Waltham, Mass. This unit comprises gears and clutches, and is operated with a lever or foot treadle for supplying individual motor drive to small lathes, milling machines, drills and miscellaneous equipment. Reverse is obtained by a reversing motor and switch. The unit eliminates countershafts, jackshafts and belting, and is quiet in operation, light in weight, powerful, compact, and free from vibration. It shifts from one speed to another while in motion or when idle.

The device may be attached under the bench, on the wall, or on the ceiling and requires little space. The driving and driven pulleys can be placed on either side. Only one belt is required from the gear drive to the machine, and only one belt, flat or V-shaped, or chain is needed from the gear drive to the motor. The case is made of two cast-iron sections with the bronze mounting lugs to prevent breakage. The four stub-tooth helical gears comprise two of Textolite and two of steel. A separate multiple-disk clutch with hardened and ground plates is provided for each speed. Full oversize ball bearings are used and run in a bath of oil.

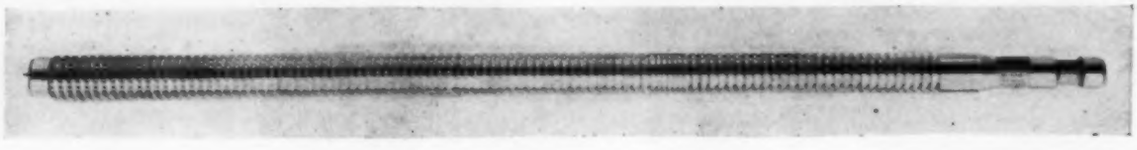
Ex-Cell-O Involute-Tooth Broach for Internal Gears

To increase production of internal gears for the automotive industry, the Ex-Cell-O Aircraft & Tool Corp., 1200 Oakman Blvd., Detroit, Mich., has designed a broach having a true involute tooth form. No additional operations are necessary as the gear is finished in one pass of the broach.

The broach starts from a drilled hole. The teeth in each row must be absolutely straight to insure accuracy and finish. The section at the pull end of the broach is designed for sizing the hole and the remainder of the broach for broaching the form on each tooth. Broaches in a range of diameters with a corresponding range in number of teeth can be furnished. Limits on these broaches are held to 0.0003 in. on the splines, outside diameter to 0.0001 in., and the accumulated error in the spacing of the teeth not to exceed 0.0002 in. The first section removes approximately 0.045 in. stock. The pull end is designed for an automatic coupling which simplifies and speeds up the handling of the broach during the broaching operation. No fixtures are required for this job, as a soft steel reducing bushing supports the part during the operation.

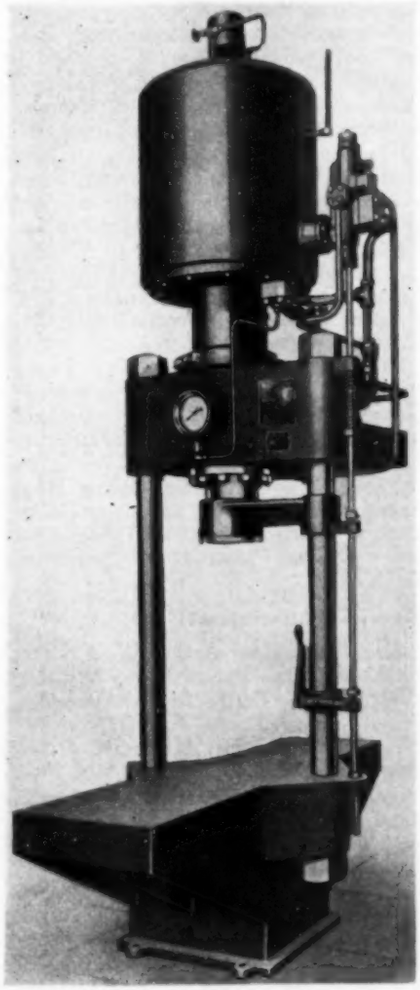
Finishing end of broach for internal involute gears

Below—The pull end, which is designed for an automatic coupling, sizes the hole, the remainder forming the teeth



"H-P-M" Two-Rod Hydro-Power Presses

Designed for straightening and assembling operations, two-rod hydro-power presses with square and extended beds have been developed by the Hydraulic Press Mfg. Co., Mt. Gilead, Ohio. . These presses differ from the open-gap type described on p. 718, Vol. 75, only in the frame arrangement and not in the operating system. The press frame is arranged vertically with the pressing plunger acting downward. Thus, the work remains stationary on the lower bed,



which may be either square or extended. The latter style is suggested for bending and straightening work. Access is afforded to the work from all sides.

On this type of press two heavy steel strain rods of large diameter provide for rigidity as well as for the necessary tensile strength. The outer ram guide bears on one of the strain rods. The head yoke is mounted on the shoulders of the two strain rods, and the two strain rod nuts are screwed into position. The head yoke holds the cylinder and the oil tank, which are mounted above.

These two-rod presses are available in six capacities from 25 to 200 tons. The square-bed is built in the following sizes: 24x24 in., and 36x36 in. The extended bed type is built in the folliwing sizes: 24x60 in. and 36x72 in.

EQUIPMENT ADAPTATIONS

RECENTLY DEVELOPED BY THE MAKERS

Assembling Bushings in Spicer-Type Universal Joints

A special, two-spindle horizontal machine has been developed by the American Broach & Machine Co., Ann Arbor, Mich., and equipped with a magazine feed and arranged for assembling bushings in Spicer-type universal joints. In assembling the joints, the yoke with the short hub is dropped over the spline shaft. The cross is then dropped into position and the other yoke placed on top of the cross. By pressing the pedal the rams are caused to advance and a hardened sleeve on the end of the ram picks up the bushing. As the rams advance farther, the center picks up the cross and lifts it into a central position. The rams continue pressing the bushing into the yoke bearing to its proper depth so that the groove around the bushing and the groove in the bushing bearing are caused to register.

The center that picks up the cross is of the disappearing type, in that it recedes into the spindle, allowing the sleeve to push the bushing in to its proper depth. Immediately upon releasing the foot pressure on the pedal, the spindle withdraws. The operator then pulls the lever one quarter turn and by means of a latch it is positioned ready for the second operation of pushing in the other two bushings. The entire assembly operation requires 20 seconds.

Adjustment of the ram is made by the adjusting nut on the opposite end of the ram, which permits the spindle to travel to the desired distance. The machine requires a 3-hp., 1,200-r.p.m.

motor, and the weight is approximately 2,000 lb. It is equipped with an American submerged hydraulic oil pump placed in the left-hand column.

TRADE PUBLICATIONS

CHAIN. The Link-Belt Co., 501 No. Holmes, Ave., Indianapolis, Ind., has issued a circular on its ⅜-in. pitch silent chain recently described in these pages. Illustrations of typical applications of this small chain are also provided.

MILLING ATTACHMENT. The Bridgeport Pattern & Model Works, 50 Remer St., Bridgeport, Conn., has issued a circular describing its high-speed attachment for milling machines, and giving specifications.

STANDARDS. The American Standards Association, 29 West 39th St., New York, N. Y., has issued a pamphlet entitled "Form and Arrangement of Published Standards," dated Nov. 25, 1931. The pamphlet comprises the report of the special committee which was appointed in Jan. 1925, to prepare recommended practices as a guide in the publication of standards.

MOLDED PRODUCTS. The Bakelite Corp., 247 Park Ave., New York, N. Y., has issued the fifth edition of its book entitled "Bakelite Molded," giving information on the resinoid itself, molding materials, machining, the molding process and equipment therefor, and standard tests. Many typical Balelite products are illustrated.

TOOLS. The Taft-Peirce Mfg. Co., Woonsocket, R. I., has issued the "Taft-Peirce Handbook" illustrating all of its tools, gages, thread rolling dies, toolroom specialties, reamers, magnetic chucks, thread milling machines, and other products. Each of these tools is compleely described and specifications are given, together with drawings and photographs. The contract service of the company and its manufacturing facilities are also discussed.

PATENTS

DECEMBER 1, 1931

Metal-Working Machinery

Metal Working Press. Fredrich J. Rode, Chicago, Ill. Patent 1,834,111.

Grinding Machine. George V. Johnston, Loveland, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,834,158.

Mechanism for Truing and Dressing Grinding Wheels. Roland P. Place, Midland, Mich., assigned to Roland P. Place Co. Patent 1,834,179.

Feed Mechanism for Punch Presses. Carl G. Liljeberg, Chicago, Ill., assigned to Shakeproof Lock Washer Co. Patent 1,834,216.

Measuring Device for Precision Grinders. Fred H. Whitman, Milwaukee, Wis., assigned to A. O. Smith Corporation. Patent 1,834,231.

Drilling Apparatus. Harry C. Johansen, Michigan City, Ind., assigned to Sullivan Machinery Co. Patent 1,834,597.

Spindle Mounting. Bruno Lundgreen, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,834,627.

Mechanism for Machining Metal Hydraulically. Robert M. Galloway, Richmond, Ind. Patent 1,834,694.

Cutting Machine (Lathe). James F. Williams, Lyndhurst, and Philip H. Hutchinson, Montclair, N. J., assigned to General Motors Corporation. Patent 1,834,755.

Mounting for the Tooth Rest of Cutter Grinders. William E. Winans, Harrisburg, Pa. Patent 1,834,816.

Electromagnetic Drilling Control for Rotary Drilling Rigs. Earl P. Blankenship and Frank E. Brock, Seminole, Okla. Patent 1,834,894.

Tools and Attachments

Portable Sanding and Polishing Device. Ralph Z. Hopkins and Earl F. Seger, Detroit, Mich., assigned to Hudson Motor Car Co. Patent 1,834,059.

Tool Feeding Apparatus. Hjalmer C. Gustafson, Denver, Colo., assigned to The Gardner-Denver Co. Patent 1,834,701.

Apparatus for Hardening Steel. James H. Hafer, Newport, Ky. Patent 1,834,702.

Universal Machine Head. John Kis, Racine, Wis. Patent 1,834,716.

Furnaces

Resistance Furnace. Guy S. Peterson, East Cleveland, Ohio, assigned to the Strong, Carlisle & Hammond Co. Patent 1,834,640.

DECEMBER 8, 1931

Metal-Working Machinery

Grinding Machine. John H. Helms, Fortville, Ind. Patent 1,835,045.

Milling Machine. Victor E. Flodin, Oak Park, Ill., assigned to Crane Co. Patent 1,835,290.

Grinding Machine. Victor E. Flodin, Oak Park, Ill., assigned to Crane Co. Patent 1,835,291.

Apparatus for Corrugating Metal Tubes. Lyman L. Lord, Boston, Mass., assigned to E. B. Badger & Sons Co. Patent 1,835,314.

Milling Machine Slide. Fred A. Parsons, Milwaukee, Wis., assigned to Kearney & Trecker Corporation. Patent 1,835,328.

Drilling Machine. George Joseph Thomas, South Bend, Ind., assigned to Bendix Brake Co. Patent 1,835,539.

Drill Head. Joseph T. Wright, Cincinnati, Ohio, assigned to The Harris-Seybold-Potter Co. Patent 1,835,551.

Automatic Work Feeding and Chucking Means for Multiple Spindle Lathes. Edward P. Bullard, Fairfield, Conn., assigned to The Bullard Co. Patent 1,835,591.

Grinding Machine. Willetts Peaslee, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,835,668.

Backing Off Mechanism for Grinding Machines. Harvey M. Allison, Worcester, Mass., assigned to John Bath. Patent 1,835,687.

Backing Off Mechanism for Grinding Machines. Ernest A. Walker and Harvey M. Allison, Worcester, Mass., assigned to John Bath. Patent 1,835,733.

Machine Tool Organization. William K. Andrew, Wauwatosa, Wis., assigned to Kearney & Trecker Corporation. Patent 1,835,742.

Milling Machine. Edward J. Kearney, Wauwatosa, Wis., assigned to Kearney & Trecker Corporation. Patent 1,835,782.

Machine Tool for Milling having Hydraulic Feed. Hans Ernst and Lester F. Nenninger, Cincinnati, Ohio, assigned to The Cincinnati Milling Machine Co. Patent 1,835,976.

Hydraulic System. Hans Ernst and Lester F. Nenninger, Cincinnati, Ohio, assigned to The Cincinnati Milling Machine Co. Patent 1,835,977.

Multiple Closed Circuit Hydraulic System. Hans Ernst and Lester F. Nenninger, Cincinnati, Ohio, assigned to The Cincinnati Milling Machine Co. Patent 1,835,978.

Three-Pump Hydraulic System. Hans Ernst and Lester F. Nenninger, Cincinnati, Ohio, assigned to The Cincinnati Milling Machine Co. Patent 1,835,979.

Tools and Attachments

Die Mechanism. Arthur W. Altvater, St. Louis, Mo. Patent 1,834,918.

Hydraulic Feed for Worktables. James Henry Lonie, La Grange, Ill., assigned to Western Electric Co., Inc. Patent 1,834,956.

Apparatus for Grinding Tools. Ferdinand Satterstrom, Faribault, Minn., assigned to The Spiral Cutter Co. Patent 1,834,972.

Screw and Nut Driving Device. Frederic E. Bertrand, Lynn, Mass., assigned to United Shoe Machinery Corporation. Patent 1,835,135.

Chuck for Axle-Turning Lathes. William Lowery, Hammond, Ind., assigned to Pittsburgh Screw & Bolt Corporation. Patent 1,835,166.

Lap. Edgar Anstett, Chicago, Ill., assigned to Richard Groetchen. Patent 1,835,257.

Grinding Fixture. Joseph C. Drader, Detroit, Mich., assigned to Michigan Tool Co. Patent 1,835,476.

Reference Book Sheet

APPROXIMATE BLANK DIAMETERS FOR CYLINDRICAL SHELLS

Dia. of Shell Ins.	HEIGHT OF SHELL, INCHES																					Dia. of Shell Ins.
	½	⅝	¾	⅞	1	1⅛	1¼	1⅜	1½	1⅝	1¾	1⅞	2	2¼	2½	2¾	3	3¼	3½	3¾	4	
¼	.75	.83	.90	.97	1.03	1.09	1.15	1.20	1.25	1.30	1.34	1.39	1.43	1.52	1.59	1.67	1.75	1.82	1.89	1.95	2.02	¼
⅜	.94	1.04	1.13	1.21	1.28	1.34	1.42	1.48	1.55	1.61	1.67	1.71	1.78	1.88	1.98	2.07	2.16	2.24	2.32	2.40	2.48	⅜
½	1.12	1.22	1.32	1.41	1.50	1.58	1.66	1.73	1.80	1.87	1.93	2.00	2.07	2.18	2.29	2.39	2.50	2.60	2.69	2.78	2.88	½
⅝	1.28	1.40	1.50	1.60	1.70	1.79	1.88	1.96	2.04	2.11	2.19	2.26	2.32	2.46	2.58	2.69	2.80	2.92	3.02	3.12	3.23	⅝
¾	1.44	1.56	1.67	1.78	1.89	1.98	2.08	2.16	2.25	2.33	2.41	2.48	2.56	2.70	2.84	2.96	3.09	3.21	3.32	3.43	3.54	¾
⅞	1.59	1.72	1.84	1.95	2.06	2.16	2.26	2.36	2.45	2.54	2.62	2.70	2.78	2.94	3.08	3.22	3.38	3.50	3.63	3.75	3.84	⅞
1	1.73	1.87	2.00	2.12	2.23	2.34	2.45	2.55	2.64	2.74	2.82	2.91	3.00	3.16	3.31	3.46	3.61	3.74	3.87	4.00	4.13	1
1⅛	1.87	2.02	2.15	2.28	2.40	2.51	2.62	2.73	2.83	2.93	3.02	3.11	3.21	3.37	3.53	3.69	3.84	3.98	4.12	4.26	4.39	1⅛
1¼	2.01	2.16	2.30	2.43	2.56	2.68	2.80	2.90	3.01	3.11	3.22	3.31	3.40	3.58	3.75	3.91	4.07	4.22	4.37	4.51	4.65	1¼
1⅜	2.16	2.31	2.45	2.59	2.72	2.84	2.96	3.08	3.18	3.29	3.39	3.49	3.59	3.77	3.95	4.12	4.28	4.44	4.59	4.74	4.88	1⅜
1½	2.29	2.45	2.60	2.74	2.87	3.00	3.12	3.24	3.36	3.46	3.58	3.67	3.77	3.97	4.15	4.33	4.50	4.66	4.82	4.97	5.12	1½
1⅝	2.42	2.59	2.74	2.89	3.02	3.15	3.28	3.40	3.52	3.63	3.74	3.85	3.95	4.15	4.34	4.53	4.70	4.87	5.03	5.20	5.35	1⅝
1¾	2.56	2.72	2.88	3.03	3.17	3.30	3.43	3.56	3.68	3.80	3.91	4.03	4.14	4.34	4.54	4.73	4.90	5.08	5.25	5.42	5.57	1¾
1⅞	2.70	2.86	3.02	3.18	3.32	3.46	3.59	3.72	3.84	3.97	4.08	4.20	4.30	4.52	4.71	4.91	5.10	5.28	5.45	5.62	5.79	1⅞
2	2.83	3.00	3.16	3.31	3.46	3.61	3.75	3.87	4.00	4.12	4.24	4.36	4.47	4.69	4.90	5.10	5.29	5.48	5.65	5.83	6.00	2
2⅛	2.96	3.13	3.30	3.46	3.61	3.75	3.89	4.02	4.16	4.28	4.40	4.52	4.64	4.86	5.08	5.28	5.48	5.67	5.85	6.03	6.21	2⅛
2¼	3.09	3.27	3.44	3.60	3.75	3.90	4.04	4.18	4.31	4.44	4.56	4.68	4.80	5.03	5.25	5.46	5.66	5.86	6.05	6.23	6.41	2¼
2⅜	3.22	3.40	3.57	3.74	3.89	4.04	4.18	4.32	4.46	4.59	4.72	4.84	4.96	5.20	5.42	5.64	5.84	6.04	6.24	6.42	6.61	2⅜
2½	3.35	3.54	3.71	3.87	4.03	4.18	4.33	4.47	4.61	4.74	4.87	5.00	5.12	5.36	5.59	5.81	6.02	6.22	6.42	6.61	6.80	2½
2⅝	3.48	3.67	3.84	4.01	4.17	4.32	4.47	4.62	4.76	4.89	5.03	5.15	5.28	5.52	5.76	5.98	6.20	6.40	6.61	6.80	6.99	2⅝
2¾	3.61	3.80	3.98	4.15	4.31	4.47	4.62	4.76	4.90	5.04	5.18	5.31	5.44	5.68	5.92	6.15	6.37	6.58	6.79	6.99	7.18	2¾
2⅞	3.75	3.93	4.11	4.28	4.45	4.60	4.76	4.91	5.05	5.19	5.33	5.46	5.59	5.84	6.08	6.32	6.54	6.76	6.96	7.17	7.37	2⅞
3	3.87	4.06	4.24	4.42	4.58	4.74	4.90	5.05	5.20	5.34	5.48	5.61	5.74	6.00	6.25	6.48	6.71	6.93	7.14	7.35	7.55	3
3⅛	4.00	4.19	4.38	4.55	4.72	4.88	5.04	5.19	5.34	5.48	5.63	5.76	5.90	6.16	6.40	6.64	6.87	7.10	7.32	7.52	7.73	3⅛
3¼	4.13	4.32	4.51	4.68	4.85	5.02	5.18	5.33	5.48	5.63	5.77	5.91	6.05	6.31	6.56	6.80	7.04	7.26	7.48	7.70	7.91	3¼
3⅜	4.26	4.45	4.64	4.82	4.99	5.15	5.31	5.47	5.62	5.77	5.92	6.05	6.19	6.47	6.72	6.96	7.20	7.43	7.66	7.87	8.08	3⅜
3½	4.39	4.58	4.77	4.95	5.12	5.29	5.45	5.61	5.77	5.91	6.06	6.20	6.35	6.61	6.87	7.12	7.37	7.60	7.83	8.05	8.26	3½
3⅝	4.51	4.71	4.90	5.08	5.26	5.43	5.59	5.75	5.90	6.06	6.21	6.35	6.49	6.76	7.03	7.28	7.52	7.76	7.99	8.21	8.43	3⅝
3¾	4.64	4.84	5.03	5.21	5.39	5.56	5.73	5.89	6.04	6.20	6.35	6.49	6.63	6.91	7.18	7.43	7.68	7.92	8.16	8.38	8.60	3¾
3⅞	4.77	4.97	5.16	5.34	5.52	5.69	5.86	6.02	6.18	6.34	6.49	6.64	6.78	7.06	7.33	7.59	7.84	8.08	8.32	8.55	8.77	3⅞
4	4.90	5.10	5.29	5.48	5.66	5.83	6.00	6.16	6.32	6.48	6.63	6.78	6.92	7.21	7.48	7.74	8.00	8.24	8.48	8.71	8.94	4
4⅛	5.02	5.22	5.42	5.61	5.79	5.96	6.13	6.30	6.46	6.62	6.77	6.92	7.07	7.36	7.63	7.89	8.15	8.40	8.64	8.88	9.11	4⅛
4¼	5.15	5.35	5.55	5.74	5.92	6.09	6.27	6.43	6.60	6.76	6.91	7.06	7.21	7.50	7.78	8.05	8.31	8.56	8.80	9.04	9.27	4¼
4⅜	5.28	5.48	5.68	5.87	6.05	6.23	6.40	6.57	6.73	6.89	7.05	7.21	7.35	7.64	7.93	8.20	8.46	8.71	8.96	9.20	9.44	4⅜
4½	5.40	5.61	5.81	6.00	6.18	6.36	6.53	6.70	6.87	7.03	7.19	7.35	7.50	7.79	8.07	8.35	8.61	8.87	9.12	9.36	9.60	4½
4⅝	5.53	5.74	5.93	6.13	6.31	6.49	6.67	6.84	7.01	7.17	7.33	7.48	7.64	7.93	8.22	8.50	8.76	9.02	9.28	9.52	9.76	4⅝
4¾	5.66	5.86	6.06	6.26	6.44	6.62	6.80	6.97	7.14	7.31	7.47	7.62	7.78	8.08	8.37	8.64	8.91	9.18	9.43	9.68	9.92	4¾
4⅞	5.78	5.99	6.19	6.39	6.57	6.76	6.93	7.11	7.28	7.44	7.60	7.76	7.92	8.22	8.51	8.79	9.06	9.33	9.59	9.84	10.08	4⅞
5	5.91	6.12	6.32	6.52	6.70	6.89	7.07	7.24	7.41	7.58	7.74	7.90	8.06	8.36	8.66	8.94	9.21	9.48	9.74	10.00	10.24	5
5⅛	6.04	6.25	6.45	6.64	6.83	7.02	7.20	7.37	7.55	7.72	7.88	8.04	8.21	8.51	8.80	9.09	9.37	9.63	9.90	10.15	10.40	5⅛
5¼	6.17	6.37	6.58	6.77	6.96	7.15	7.33	7.51	7.68	7.85	8.02	8.18	8.34	8.65	8.94	9.23	9.51	9.78	10.05	10.31	10.56	5¼
5⅜	6.29	6.50	6.71	6.90	7.09	7.28	7.46	7.64	7.82	7.99	8.15	8.31	8.48	8.79	9.09	9.38	9.66	9.93	10.20	10.46	10.72	5⅜
5½	6.42	6.63	6.83	7.03	7.22	7.41	7.60	7.77	7.95	8.12	8.29	8.45	8.61	8.93	9.23	9.52	9.81	10.08	10.35	10.62	10.87	5½
5⅝	6.54	6.76	6.96	7.16	7.35	7.54	7.73	7.91	8.08	8.25	8.42	8.59	8.75	9.07	9.37	9.67	9.95	10.23	10.50	10.77	11.02	5⅝
5¾	6.67	6.88	7.09	7.29	7.48	7.67	7.86	8.04	8.22	8.39	8.56	8.72	8.89	9.20	9.51	9.81	10.10	10.38	10.65	10.92	11.18	5¾
5⅞	6.80	7.01	7.22	7.42	7.61	7.80	7.99	8.17	8.35	8.52	8.69	8.86	9.02	9.34	9.65	9.95	10.24	10.52	10.80	11.07	11.33	5⅞
6	6.92	7.14	7.34	7.55	7.74	7.93	8.12	8.30	8.48	8.66	8.83	9.00	9.16	9.48	9.79	10.09	10.39	10.67	10.95	11.22	11.48	6
6¼	7.18	7.39	7.60	7.80	8.00	8.19	8.38	8.57	8.75	8.92	9.10	9.27	9.44	9.76	10.07	10.38	10.68	10.96	11.25	11.52	11.79	6¼
6½	7.43	7.64	7.85	8.06	8.26	8.45	8.64	8.83	9.01	9.19	9.36	9.54	9.71	10.03	10.35	10.66	10.96	11.25	11.54	11.82	12.09	6½
6¾	7.68	7.90	8.11	8.31	8.51	8.71	8.90	9.09	9.27	9.45	9.63	9.80	9.97	10.31	10.63	10.94	11.25	11.54	11.83	12.11	12.39	6¾
7	7.93	8.15	8.36	8.57	8.77	8.97	9.16	9.35	9.53	9.72	9.90	10.07	10.24	10.58	10.90	11.22	11.53	11.83	12.12	12.40	12.68	7
7¼	8.18	8.40	8.62	8.82	9.03	9.22	9.42	9.61	9.80	9.98	10.16	10.34	10.51	10.85	11.18	11.50	11.81	12.11	12.41	12.70	12.98	7¼
7½	8.44	8.66	8.87	9.08	9.28	9.48	9.68	9.87	10.06	10.24	10.42	10.60	10.78	11.12	11.45	11.77	12.09	12.39	12.69	12.99	13.27	7½
7¾	8.69	8.91	9.12	9.33	9.54	9.74	9.94	10.13	10.32	10.50	10.69	10.87	11.04	11.39	11.72	12.05	12.37	12.68	12.98	13.27	13.56	7¾
8	8.94	9.16	9.38	9.59	9.79	10.00	10.19	10.39	10.58	10.77	10.95	11.13	11.31	11.66	11.99	12.32	12.64	12.96	13.26	13.56	13.85	8
8¼	9.19	9.41	9.63	9.84	10.05	10.25	10.45	10.65	10.84	11.03	11.21	11.39	11.57	11.92	12.27	12.60	12.92	13.23	13.54	13.84	14.14	8¼
8½	9.44	9.66	9.88	10.10	10.30	10.51	10.71	10.90	11.10	11.29	11.47	11.66	11.84	12.19	12.53	12.87	13.20	13.51	13.82	14.13	14.43	8½
8¾	9.69	9.92	10.13	10.35	10.56	10.76	10.96	11.16	11.36	11.55	11.73	11.92	12.10	12.46	12.80	13.14	13.47	13.79	14.10	14.41	14.71	8¾
9	9.95	10.17	10.39	10.60	10.81	11.02	11.21	11.42	11.61	11.81	11.99	12.18	12.36	12.72	13.07	13.41	13.74	14.07	14.38	14.69	14.99	9
9¼	10.20	10.42	10.64	10.85	11.07	11.27	11.48	11.68	11.87	12.07	12.26	12.44	12.63	12.99	13.34	13.68	14.02	14.34	14.66	14.97	15.28	9¼
9½	10.45	10.67	10.89	11.11	11.32	11.53	11.73	11.93	12.13	12.32	12.52	12.70	12.89	13.25	13.61	13.95	14.29	14.61	14.94	15.25	15.56	9½
9¾	10.70	10.92	11.14	11.36	11.57	11.78	11.99	12.19	12.39	12.58	12.77	12.96	13.15	13.52	13.87	14.22	14.56	14.89	15.21	15.53	15.84	9¾
10	10.95	11.18	11.40	11.61	11.83	12.04	12.24	12.44	12.64	12.84	13.03	13.22	13.41	13.78	14.14	14.49	14.83	15.16	15.49	15.81	16.12	10
10¼	11.20	11.43	11.65	11.87	12.08	12.29	12.50	12.70	12.90	13.10	13.29	13.48	13.67	14.04	14.40	14.75	15.10	15.43	15.76	16.08	16.40	10¼
10½	11.45	11.68	11.90	12.12	12.33	12.54	12.75	12.96	13.16	13.36	13.55	13.74	13.93	14.30	14.66	15.02	15.36	15.70	16.03	16.36	16.68	10½
10¾	11.70	11.93	12.15	12.37	12.59	12.80	13.01	13.21	13.41	13.61	13.81	14.00	14.19	14.56	14.93	15.29	15.63	15.97	16.31	16.63	16.96	10¾
11	11.95	12.18	12.40	12.62	12.84	13.05	13.26	13.47	13.67	13.87	14.07	14.26	14.45	14.83	15.19	15.55	15.90	16.24	16.58	16.91	17.22	11
11¼	12.20	12.43	12.67	12.91	13.09	13.30	13.52	13.72	13.93	14.13	14.33	14.52	14.71	15.08	15.46	15.82	16.17	16.52	16.84	17.17	17.50	11¼
11½	12.45	12.65	12.90	13.11	13.35	13.56	13.77	13.98	14.18	14.38	14.58	14.78	14.97	15.35	15.72	16.08	16.43	16.78	17.11	17.45	17.78	11½
11¾	12.66	12.92	13.16	13.39	13.59	13.82	14.03	14.23	14.44	14.63	14.84	15.04	15.22	15.60	15.98	16.34	16.70	17.05	17.39	17.73	18.05	11¾
12	12.96	13.20	13.42	13.63	13.86	14.07	14.28	14.49	14.70	14.88	15.10	15.30	15.50	15.88	16.24	16.61	16.96	17.32	17.66	18.00	18.33	12
Dia. of Shell Ins.	½	⅝	¾	⅞	1	1⅛	1¼	1⅜	1½	1⅝	1¾	1⅞	2	2¼	2½	2¾	3	3¼	3½	3¾	4	Dia. of Shell Ins.

Courtesy Toledo Machine & Tool Co.

HEIGHT OF SHELL, INCHES (over)

© American Machinist

APPROXIMATE BLANK DIAMETERS FOR CYLINDRICAL SHELLS

Diameter of Shell Inches	HEIGHT OF SHELL, INCHES																					Diameter of Shell Inches
	4¼	4½	4¾	5	5¼	5½	5¾	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12		
¼	2.08	2.13	2.20	2.25	2.31	2.36	2.41	2.46	2.56	2.66	2.75	2.83	2.93	3.01	3.09	3.17	3.25	3.33	3.40	3.48		¼
⅜	2.55	2.63	2.70	2.76	2.83	2.90	2.96	3.03	3.15	3.27	3.38	3.48	3.59	3.70	3.80	3.90	3.98	4.08	4.17	4.26		⅜
½	2.96	3.04	3.12	3.20	3.28	3.35	3.42	3.50	3.64	3.77	3.90	4.03	4.15	4.27	4.39	4.50	4.61	4.71	4.82	4.93		½
⅝	3.32	3.42	3.50	3.59	3.68	3.76	3.84	3.92	4.08	4.23	4.38	4.52	4.65	4.78	4.91	5.04	5.16	5.28	5.39	5.51		⅝
¾	3.65	3.75	3.85	3.94	4.03	4.13	4.22	4.30	4.48	4.64	4.80	4.96	5.10	5.25	5.39	5.53	5.66	5.79	5.92	6.05		¾
⅞	3.95	4.06	4.17	4.27	4.39	4.47	4.57	4.66	4.84	5.03	5.19	5.36	5.52	5.68	5.83	5.98	6.12	6.26	6.40	6.53		⅞
1	4.24	4.35	4.46	4.58	4.69	4.79	4.89	5.00	5.19	5.39	5.57	5.74	5.92	6.08	6.24	6.40	6.56	6.71	6.86	7.00		1
1⅛	4.51	4.63	4.75	4.87	4.98	5.10	5.21	5.31	5.52	5.72	5.92	6.10	6.28	6.46	6.63	6.80	6.96	7.12	7.28	7.43		1⅛
1¼	4.78	4.90	5.03	5.15	5.27	5.39	5.50	5.61	5.84	6.04	6.25	6.45	6.64	6.82	7.00	7.18	7.35	7.52	7.68	7.84		1¼
1⅜	5.02	5.16	5.29	5.42	5.54	5.67	5.79	5.90	6.13	6.35	6.57	6.78	6.97	7.16	7.35	7.54	7.73	7.89	8.07	8.24		1⅜
1½	5.26	5.40	5.54	5.68	5.81	5.93	6.07	6.19	6.42	6.65	6.87	7.09	7.30	7.50	7.70	7.89	8.08	8.26	8.44	8.62		1½
1⅝	5.50	5.64	5.78	5.92	6.06	6.20	6.33	6.45	6.70	6.94	7.17	7.39	7.61	7.82	8.02	8.22	8.42	8.61	8.80	8.98		1⅝
1¾	5.72	5.88	6.02	6.17	6.31	6.45	6.58	6.71	6.97	7.22	7.46	7.69	7.91	8.13	8.34	8.55	8.75	8.95	9.14	9.33		1¾
1⅞	5.95	6.10	6.25	6.41	6.55	6.69	6.83	6.96	7.23	7.49	7.73	7.97	8.20	8.43	8.64	8.86	9.07	9.27	9.48	9.67		1⅞
2	6.16	6.32	6.48	6.63	6.78	6.93	7.07	7.21	7.49	7.75	8.00	8.25	8.48	8.72	8.94	9.17	9.38	9.59	9.80	10.00		2
2⅛	6.38	6.54	6.70	6.86	7.01	7.16	7.31	7.45	7.73	8.00	8.26	8.52	8.76	9.00	9.23	9.46	9.68	9.90	10.11	10.32		2⅛
2¼	6.58	6.75	6.91	7.08	7.23	7.39	7.54	7.68	7.97	8.25	8.52	8.78	9.03	9.28	9.52	9.75	9.98	10.21	10.42	10.63		2¼
2⅜	6.78	6.96	7.13	7.29	7.45	7.61	7.76	7.91	8.21	8.49	8.77	9.03	9.29	9.55	9.79	10.03	10.26	10.49	10.72	10.94		2⅜
2½	6.98	7.16	7.33	7.50	7.66	7.82	7.98	8.14	8.44	8.73	9.01	9.29	9.55	9.81	10.06	10.31	10.55	10.78	11.01	11.24		2½
2⅝	7.18	7.36	7.53	7.71	7.88	8.04	8.20	8.36	8.67	8.97	9.25	9.53	9.80	10.07	10.33	10.58	10.82	11.06	11.30	11.53		2⅝
2¾	7.37	7.55	7.73	7.91	8.08	8.25	8.41	8.58	8.89	9.20	9.49	9.78	10.05	10.32	10.59	10.84	11.09	11.33	11.58	11.81		2¾
2⅞	7.56	7.75	7.93	8.11	8.29	8.46	8.62	8.79	9.11	9.42	9.72	10.01	10.29	10.57	10.84	11.11	11.35	11.61	11.85	12.09		2⅞
3	7.75	7.94	8.12	8.30	8.48	8.66	8.83	9.00	9.33	9.64	9.95	10.25	10.53	10.82	11.09	11.36	11.62	11.87	12.12	12.37		3
3⅛	7.93	8.12	8.31	8.50	8.68	8.86	9.03	9.20	9.54	9.86	10.17	10.48	10.77	11.06	11.34	11.61	11.88	12.13	12.39	12.64		3⅛
3¼	8.11	8.31	8.50	8.69	8.88	9.06	9.23	9.41	9.75	10.08	10.40	10.70	11.00	11.29	11.58	11.86	12.13	12.39	12.65	12.90		3¼
3⅜	8.29	8.49	8.69	8.88	9.07	9.25	9.43	9.61	9.96	10.29	10.61	10.93	11.23	11.53	11.82	12.10	12.37	12.64	12.91	13.17		3⅜
3½	8.47	8.68	8.87	9.06	9.26	9.45	9.63	9.81	10.16	10.50	10.83	11.15	11.46	11.76	12.05	12.34	12.62	12.89	13.16	13.43		3½
3⅝	8.65	8.85	9.06	9.25	9.45	9.64	9.82	10.00	10.36	10.71	11.04	11.36	11.68	11.98	12.28	12.57	12.86	13.14	13.41	13.68		3⅝
3¾	8.82	9.03	9.23	9.44	9.63	9.82	10.01	10.20	10.56	10.91	11.25	11.58	11.90	12.21	12.51	12.80	13.09	13.37	13.65	13.93		3¾
3⅞	8.99	9.20	9.41	9.61	9.82	10.01	10.20	10.39	10.76	11.11	11.45	11.79	12.11	12.43	12.74	13.04	13.33	13.62	13.90	14.18		3⅞
4	9.16	9.38	9.59	9.79	10.00	10.20	10.39	10.58	10.95	11.31	11.66	12.00	12.33	12.65	12.96	13.26	13.56	13.85	14.14	14.42		4
4⅛	9.33	9.55	9.76	9.97	10.18	10.38	10.57	10.76	11.14	11.51	11.86	12.20	12.54	12.86	13.18	13.49	13.79	14.09	14.38	14.66		4⅛
4¼	9.50	9.72	9.94	10.15	10.35	10.56	10.76	10.95	11.33	11.71	12.06	12.41	12.75	13.07	13.40	13.72	14.02	14.32	14.61	14.90		4¼
4⅜	9.67	9.89	10.11	10.32	10.53	10.74	10.94	11.14	11.52	11.90	12.26	12.61	12.95	13.29	13.61	13.93	14.24	14.54	14.84	15.13		4⅜
4½	9.83	10.06	10.28	10.50	10.71	10.92	11.12	11.32	11.71	12.09	12.45	12.81	13.16	13.50	13.82	14.15	14.45	14.77	15.07	15.37		4½
4⅝	10.00	10.22	10.45	10.67	10.88	11.09	11.30	11.50	11.90	12.28	12.65	13.01	13.36	13.70	14.04	14.36	14.68	14.99	15.30	15.60		4⅝
4¾	10.16	10.39	10.62	10.84	11.05	11.27	11.47	11.68	12.08	12.47	12.84	13.21	13.56	13.91	14.25	14.57	14.90	15.22	15.52	15.83		4¾
4⅞	10.32	10.55	10.78	11.01	11.23	11.44	11.65	11.86	12.26	12.65	13.03	13.41	13.76	14.11	14.45	14.79	15.11	15.43	15.74	16.05		4⅞
5	10.48	10.72	10.95	11.18	11.40	11.61	11.83	12.04	12.45	12.84	13.23	13.60	13.96	14.32	14.66	15.00	15.33	15.65	15.97	16.28		5
5⅛	10.65	10.88	11.12	11.34	11.57	11.79	12.00	12.21	12.63	13.03	13.41	13.79	14.16	14.52	14.86	15.21	15.54	15.87	16.19	16.50		5⅛
5¼	10.80	11.04	11.28	11.51	11.74	11.96	12.17	12.39	12.81	13.21	13.60	13.98	14.35	14.71	15.07	15.41	15.75	16.08	16.40	16.72		5¼
5⅜	10.96	11.20	11.44	11.68	11.90	12.13	12.35	12.56	12.98	13.39	13.79	14.17	14.54	14.91	15.27	15.61	15.95	16.29	16.61	16.93		5⅜
5½	11.12	11.36	11.60	11.84	12.07	12.29	12.52	12.73	13.16	13.57	13.97	14.36	14.73	15.11	15.47	15.82	16.16	16.50	16.83	17.15		5½
5⅝	11.28	11.52	11.76	12.00	12.23	12.46	12.69	12.90	13.33	13.75	14.15	14.54	14.93	15.30	15.66	16.02	16.36	16.70	17.04	17.36		5⅝
5¾	11.43	11.68	11.92	12.16	12.40	12.63	12.85	13.07	13.51	13.93	14.33	14.73	15.11	15.49	15.86	16.21	16.57	16.91	17.25	17.58		5¾
5⅞	11.59	11.84	12.08	12.32	12.56	12.79	13.02	13.24	13.68	14.10	14.51	14.91	15.30	15.68	16.05	16.42	16.77	17.11	17.45	17.79		5⅞
6	11.74	12.00	12.24	12.48	12.72	12.96	13.19	13.41	13.85	14.28	14.69	15.10	15.49	15.87	16.24	16.61	16.97	17.32	17.66	18.00		6
6¼	12.05	12.31	12.56	12.80	13.05	13.28	13.52	13.74	14.19	14.63	15.05	15.46	15.86	16.25	16.63	17.00	17.36	17.72	18.07	18.41		6¼
6½	12.36	12.62	12.87	13.12	13.37	13.61	13.85	14.08	14.53	14.97	15.40	15.82	16.22	16.62	17.00	17.38	17.75	18.11	18.47	18.82		6½
6¾	12.66	12.92	13.18	13.43	13.68	13.93	14.17	14.40	14.86	15.31	15.75	16.17	16.58	16.98	17.38	17.76	18.14	18.50	18.87	19.22		6¾
7	12.96	13.23	13.49	13.74	14.00	14.24	14.49	14.73	15.19	15.65	16.09	16.52	16.94	17.34	17.74	18.13	18.52	18.89	19.26	19.62		7
7¼	13.25	13.52	13.79	14.05	14.31	14.56	14.80	15.05	15.52	15.98	16.43	16.86	17.29	17.70	18.11	18.51	18.89	19.27	19.64	20.01		7¼
7½	13.55	13.82	14.09	14.36	14.62	14.87	15.12	15.37	15.85	16.31	16.77	17.21	17.64	18.06	18.47	18.87	19.26	19.65	20.03	20.40		7½
7¾	13.84	14.12	14.39	14.66	14.92	15.18	15.43	15.68	16.17	16.64	17.10	17.55	17.98	18.41	18.82	19.23	19.63	20.02	20.40	20.78		7¾
8	14.14	14.42	14.69	14.96	15.23	15.49	15.74	15.99	16.49	16.97	17.43	17.88	18.33	18.76	19.18	19.59	19.99	20.39	20.78	21.16		8
8¼	14.43	14.71	14.99	15.26	15.53	15.79	16.05	16.31	16.80	17.29	17.76	18.22	18.66	19.10	19.53	19.95	20.36	20.76	21.15	21.54		8¼
8½	14.72	15.00	15.28	15.56	15.83	16.10	16.36	16.62	17.12	17.61	18.09	18.55	19.00	19.44	19.88	20.30	20.71	21.11	21.51	21.91		8½
8¾	15.00	15.29	15.58	15.86	16.13	16.40	16.66	16.92	17.43	17.93	18.41	18.88	19.34	19.78	20.22	20.65	21.07	21.48	21.88	22.28		8¾
9	15.29	15.58	15.87	16.15	16.43	16.70	16.97	17.23	17.74	18.24	18.73	19.20	19.67	20.12	20.56	21.00	21.42	21.84	22.24	22.64		9
9¼	15.58	15.87	16.16	16.44	16.72	17.00	17.26	17.53	18.05	18.56	19.05	19.53	20.00	20.45	20.90	21.34	21.77	22.19	22.60	23.00		9¼
9½	15.86	16.16	16.45	16.74	17.02	17.29	17.57	17.83	18.36	18.87	19.37	19.85	20.32	20.79	21.24	21.68	22.11	22.54	22.96	23.37		9½
9¾	16.14	16.44	16.74	17.03	17.31	17.59	17.86	18.14	18.66	19.18	19.68	20.17	20.65	21.12	21.57	22.02	22.46	22.89	23.31	23.72		9¾
10	16.43	16.73	17.02	17.31	17.60	17.88	18.15	18.43	18.97	19.49	20.00	20.49	20.97	21.44	21.90	22.36	22.80	23.24	23.66	24.08		10
10¼	16.71	17.01	17.31	17.60	17.89	18.18	18.46	18.73	19.27	19.80	20.31	20.81	21.29	21.77	22.23	22.69	23.14	23.58	24.01	24.43		10¼
10½	16.99	17.29	17.59	17.89	18.18	18.47	18.75	19.03	19.57	20.10	20.62	21.12	21.61	22.09	22.56	23.02	23.47	23.92	24.35	24.78		10½
10¾	17.27	17.58	17.88	18.18	18.47	18.76	19.04	19.32	19.87	20.40	20.93	21.43	21.93	22.41	22.89	23.35	23.81	24.25	24.69	25.13		10¾
11	17.55	17.86	18.16	18.46	18.76	19.05	19.33	19.62	20.17	20.71	21.23	21.74	22.24	22.73	23.21	23.68	24.14	24.59	25.04	25.47		11
11¼	17.81	18.12	18.44	18.74	19.03	19.33	19.62	19.90	20.46	21.01	21.54	22.05	22.55	23.06	23.54	24.00	24.47	24.92	25.37	25.82		11¼
11½	18.09	18.41	18.71	19.02	19.32	19.63	19.92	20.20	20.76	21.30	21.84	22.36	22.87	23.36	23.85	24.33	24.80	25.25	25.70	26.15		11½
11¾	18.38	18.70	19.01	19.32	19.61	19.90	20.21	20.50	21.05	21.61	22.14	22.67	23.18	23.68	24.17	24.66	25.13	25.58	26.04	26.49		11¾
12	18.64	18.97	19.28	19.59	19.89	20.20	20.49	20.77	21.35	21.90	22.45	22.97	23.50	23.99	24.48	24.97	25.45	25.93	26.37	26.84		12
Diameter of Shell Inches	4¼	4½	4¾	5	5¼	5½	5¾	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12		Diameter of Shell Inches
	HEIGHT OF SHELL, INCHES																					

Courtesy Toledo Machine & Tool Co.

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AMERICAN MACHINIST

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

New York, December 17, 1931

VOL. 75 NO. 25

Why Easter?

In this space last week we published an editorial entitled "Out by Easter." Almost immediately there arose a barrage of questions: Are you actually trying to call the turn? Aren't you skating on pretty thin ice? Why Easter anyway? Why not Memorial Day, or Labor Day?

All are perfectly fair questions; all go to prove that the original statement should be amplified and explained. We knew we were skating on thin ice, but if you will return to last week's issue, you will see that we attempted no prophecy—nothing in fact beyond a bare outline of the sound business policies underlying the success of companies in our field. We stated that if your company will take four logical steps, "you and your plant and your employees will be out of the depression by Easter." That is hardly an attempt to call the turn. And, barring actual insolvency, we still insist that you can be out by Easter, if you only will.

But "why Easter?"

That is something else again, something very important indeed.

Whether or not there is any natural law involved, the first months of any year are the months of preparation for all spring and summer growth in the northern hemisphere. In agriculture as in wild life the fact certainly holds true. The same fact is found in the great majority of businesses. But strangely enough, Easter—the Christian Holy Day falling at the same time of year as many a pagan holiday—seems to have been one of the forces which have compressed the most vital business activities of the year into the first three months.

Leaving aside but not forgetting the prime importance of retail trade, which inevitably drives toward its Easter peak, we find thousands of manufacturers in the machinery and metal-working industry whose major sales are made in January, February and March for spring, summer and fall delivery. They know and can tell you from their honest and sometimes bitter experience that if they do not get off to a good start early in the year, they had best not start at all.

If this damnable depression of ours is going to be licked, each individual company must strip for action. Forget the soft and easy days of "the new era," and set your business in order. The point we most devoutly wish to make is that if enough businesses do not come out of the depression by Easter all of us will have to wait another year. And millions of us simply cannot afford to wait that long.

"They Don't Speak Our Language"

"Get that dolly into the daylight and pinch her easy in that dimple under those ears somewhere where she'll bite and hold. I've gotta mike this nose and then set up the old man to hold a blow twister." These toyshop echoes are heard in the shop day after day whenever a hole must be drilled with a pneumatic drill on the face of a punching die "in place."

Holiday, J-bar, spud, jimmy, dog, frog, tail, clapper box, file back, leg, and dozens of others are common every day terms for describing shop objects and operations. We smile with superiority at England's "petrol," "lorry," "earthed" for "grounded," "case in" for cored, a "he and she" fit, and so on; but are not our own terms just as confusing?

It would be interesting and informative to collect a dictionary of shop terms in common usage. But more important is the collecting and stand-

ardizing of names for the same objects. A "dolly" may be a small truck, a skid platform, a small crowbar, or a wooden horse, and the terms are constantly interchanged. The small crowbar may be called dolly, jimmy, spud, mick, or pincher, depending upon the section of the country in which it is being used. A dog may be employed on a lathe, shaper, or any other shop tool or even a press or cooling bed. He may or may not be tailed, sometimes he bites, and when not oiled he growls, but who knows when?

You yourself are familiar with other shop expressions used in your section of the country. Send them in, and we'll present the lot together. And then, "Get that dog out from under the bed and put him on the arbor with his tail in that chuck hole so he'll bite."

◂◂ CHIPS ▸▸

With Christmastide approaching, and with America needing world good will as never before, our Representatives in Congress seem hellbent on destroying every last vestige of international friendship . . . Why they should even think of putting European nations into the embarrassing position of technical default is beyond comprehension . . . Europe will get the moratorium, but we shall have lost all the good will that it might have brought us . . . President Hoover's numerous messages are being received variously . . . Why he has left so much up to the Congress is a serious question . . . U. S. Treasury announces that proposed tax schedules are predicated on a 15 per cent rise in industrial production . . . The 1,300,000,000 dollar Treasury offering is oversubscribed by 484,068,900 dollars . . . Savings bank deposits increase 500,000,000 dollars during 1931 . . . and some still think the U. S. bankrupt . . . Secretary Mellon suggests that corporations be authorized to deduct charity contributions, up to 15 per cent of net, from corporation income tax returns . . . Democrats in Congress repudiate the dole as an unemployment relief policy . . . but try to get them to scale down or cancel war debts . . . War Department reports that the proposed canal across Nicaragua should be indefinitely postponed.

Charles L. Allen, president and general manager, The Norton Company, is recipient of special honors on the occasion of his completing fifty years of leadership . . . Executives of the Class I railroads accept the modified I.C.C. project for increased freight rates . . . effective January 1, 1932 . . . Automobile Chamber of Commerce points out that its industry supports 4,000,000 persons and requests moderation in motor car taxes . . . Representatives of 62 manufacturers form the Materials Handling Institute.

Booming for weeks, Great Britain begins to feel pinch of new monetary and tariff policies . . . Retaliatory political and economic realignments seem to be forming on the Continent . . . French Chamber of Deputies votes to cover 100,000,000 dollar loss sustained by the Bank of France when England departed from the gold standard . . . Such a step would probably be too practical for our law makers . . . Bruening gains favor with his emergency economy measures . . . calculated to reduce German price level 10 per cent and thus reopen export markets . . . The French think he is edging toward fascism . . . U.S.S.R. Aviation Commission arrives to study U.S. airlines . . . Japan and China accept the League's formula for peace, but there is no telling what the new Japanese cabinet will do to it . . . Japan forbids gold exports . . . The yen may decline, but domestic business begins to boom.

> With productive labor forming, in many products, a small part of total cost, a logical beginning point for making savings in an individual plant is more likely to be found in overhead laxness and in obsolete equipment and methods.

Definitely announced that the refrigerator industry has sold more than 1,000,000 units during 1931 . . . Compare it with 775,000 in 1930, and 660,000 in 1929 . . . Electric range people will step out after the same kind of prosperity in 1932 . . . one company alone is already committed to spend 1,250,000 dollars in 1932 advertising . . . several times the 1931 appropriation . . . As a group, the electric range manufacturers will spend 3,600,000 in cooperative advertising . . . Watch air conditioning sales next year . . . and don't forget that washing machines and refrigerators will still be in the field and the running . . . As a result of the introduction of the new Chevrolets, 89,000 workers are back on their jobs . . . In ingot production, the steel industry operated in November at a rate 2.25 points above October . . . The Harnischfeger Corporation puts 100 additional men on the payroll . . . result of big excavator order from Macedonia . . .

John Deere Tractor Company recalls 1,000 men to its Waterloo, Iowa, plant . . . November General Motors car and truck sales top October sales to dealers by 13.1 per cent . . . Baldwin Locomotive Works and affiliated companies book 2,126,000 dollar in November . . . double October bookings . . . Milwaukee Road recalls 900 in the car and locomotive departments . . . Lincoln Motor Company now employs 2,850 men, approximately the same number as during the peak of last spring's production . . . American airlines carried 428,465 passengers during the first ten months of 1931, or 2.6 more than they carried during the whole of 1930 . . . Sikorsky books order for another giant airliner for Pan-American Airways.

"How would you like to have all the steel treating you want done during December, but not have to pay for it until February?" Thus one heat-treating job shop announces its deferred billing plan in order to pry business loose from year-end tight-wads. Advantages: Gives the customer a jump on his competition; Avoids delays in January; Hastens his shipments; Quickens the time his checks come in.

THIS WEEK IN *AM*

Last week we published a prescription (page 906a) calling for bitter medicine. This week, although little of the bitterness could be extracted, we publish another editorial (page 944a) amplifying and explaining the first. It is to be hoped that you have been able to find time to read it. Its title is "Why Easter?"

"Progressive Replacement at Half a Mililon a Year" is the leading article (page 908). As stated elsewhere there is something about the very title to fire the imagination. Few plants, indeed, can boast of a tool inventory totalling that figure, yet Westinghouse Electric & Mfg. Company has been purchasing that many tools each year for the East Pittsburgh Works alone. J. R. Weaver, the author, tells a straightforward story since he has no need whatever for dramatics.

Two articles are especially timely. We are just entering inventory time, and unless our guess misses, you are going to be interested in the subject of stock parts for old models. Deane S. Hazen, industrial consultant, has packed a whole lot of meat into "Stocking Parts for Old Machines" (page 921). Already, as you are undoubtedly aware, we are in charity time, and Ed's comments in the Foreman's Round Table (page 918) may very likely strike right where you live. Whatever your opinions, the editors of *AM* would appreciate having them in writing for publication.

The second installment in the series covering R. Hoe & Co., Inc., methods appears under the title of "Erecting Modern Printing Presses" (page 923). If your plant is still assembling heavy machinery by means of plumb bob and level, pass this article along to the man who is responsible. And if your jig borers are still being used solely as toolroom machines, turn back to "Jig Borers on Production Jobs" (page 928).

"Approximate Blank Diameters for Cylindrical Shells" (page 943) will be found a double Reference Book Sheet. You will agree that it is probably the most complete of its kind ever published.

• COMING •

Seven down and one to go. All good things seem finally to come to an end, and the issue of December 24, will carry the eighth of the eight finalist briefs for the *American Machinist* Awards for 1931. If favorable comment is any index of the intense interest found in these excellent equipment replacement plans, the plus majority of *AM* readers may very likely be calling for more this coming year. Suffice it to say now that the brief of the Rotor Air Tool Company will form a fitting climax to the series. The management, not satisfied to stop with a definite policy for replacing machine tools, has extended the good work to jigs, fixtures, and even to office equipment. Reserve an hour to study the whole plan in detail.

Other interesting things to come in the next issue will be a complete description of a privately built, cost reducing vertical milling machine, an article setting forth fine points in the operation of optical bevel protractors, and as the third in the R. Hoe & Co., Inc., series, the low-down on how this company keeps down its field erection costs. "Psychology and Salesmanship in Time Studies" will contain pointers for every shop executive and some front office executives as well.

Just every so often in we do not know how many years, a particular year contains 53 Thursdays. And since Thursday is publication day for *AM* you are going to receive 53 *Machinists* in 1931 for the price of 52. For that reason, the editors are planning something different for the issue of December 31. Perhaps we can tell you more about it next week.

Progress in Metal-Working and Machinery Markets

INQUIRIES, but not so many orders, characterize the close of a poor month ending a poor year . . . Here and there an order is closed or some new prospect is developed, but in general, business is still awaiting an industrial Napoleon . . . The latest source of worry is the new Congress, but this in itself is just an additional element in a series of business breakers . . . The truth of the matter is that tool builders and dealers very probably face another lean year unless industry can be stirred from its lethargy—and that stirring must be done at once . . . November N.M.T.B.A. indexes will be up about 5 points, and December is maintaining the gain.

NEW YORK had one aggressive dealer with a good week and further Navy inquiries . . . Otherwise little is developing or is expected to develop until the new year . . . Cincinnati expects no immediate upward trend, but two builders noted an upturn in inquiries; selling agents disposed of an occasional tool for replacement . . . Philadelphia hopes for something indirectly from a big rayon machinery order received by Budd; otherwise the situation holds little for two or three months to come . . . Chicago's December was the lowest month of the year in sales, though inquiries are pulling up a bit; used tools are slow . . . New England builders and dealers hope for action after the turn of the year from automotive and other industrial concerns.

BUFFALO has had several orders for single units, though the general situation is about as it was . . . Detroit's November sales were lower than the year's average, and December will apparently be even lower . . . Automobile production is, however, advancing, and this may mean sales soon . . . Prohibitive allowances for old equipment are Detroit's own contribution to price cutting . . . Milwaukee alone of tool centers is quite optimistic . . . November's improvement is being maintained, and orders are following betterment in general business.

NEW YORK

One aggressive dealer had a good week, with several sales, including a lathe for the Navy Yard, and some good prospects. Others saw no change, except perhaps for a slight improvement in inquiries. Little of importance is expected until after the usual January budget meetings. The Navy is inquiring for 3 shapers, 3 radials, a power press brake, grinder, vertical miller, and bolt threader, bids to be in Jan. 5.

CINCINNATI

Two machine tool manufacturers note a slight improvement in demand, but this is not regarded as an indication of a general upward trend. Selling agents are booking an occasional small order and developing a few prospects. The needs of buyers are almost entirely confined to single tools for replacement, and very few inquiries are for more than one item.

PHILADELPHIA

Announcement by the Edward G. Budd Mfg. Co. of an order for machinery for the Furness Corp., Gloucester, N. J., manufacturer of rayon, featured the market. Otherwise the situation presented the same listless aspect, with no indications of how soon a betterment will prevail. Leaders predict it will be at least two to three months before there is an adjustment.

CHICAGO

December thus far has failed to develop any upward trend, according to distributors and selling agents, a few of whom declare that in the last month it has dropped to perhaps the lowest level of the year. This applies more particularly to sales. Inquiries are increasing in volume and look better. It is the consensus of opinion that little is to be expected in the way of improvement until after the holiday season and the completion of annual inventory taking. A few optimists there are who claim to find in the character of the inquiries they have received an indication that business in machinery and tools will start upward before 1932 is far advanced; by Feb. 1 at the outside. Dealers specializing in used tools report no change.

NEW ENGLAND

Machine tool transactions of the week were comparatively few and reported from widely scattered centers. The trade is wrapped in a pronounced tranquility, which though seasonal, is much more apparent than in other years.

Pointed action lies beyond the turn of the year, and builders are hopeful of more favorable developments from foreign and domestic sources. The latter includes automotive manufacturing centers and miscellaneous concerns planning a general revamping of machine tool equipment, imperative factors in the immediate trend of the industry. New England companies have figured on the latest lathe inquiries from the Navy but no orders have been placed.

BUFFALO

Sales of machine tools are about the same. Several orders for single pieces of equipment have been placed. Demand for electrical equipment is slow. Contractor's equipment demand is dull, except snow removal equipment. Several orders of the latter are being held up because of the lack of snow. The trend is optimistic.

DETROIT

November sales were lower than the average for the year, and December will apparently be even lower. A considerable decrease in general optimism has been evidenced within the last two weeks. The few orders that have been given are, in most cases, being held for future release. These release dates are indefinite and apparently depend on the general business outlook.

Automobile production is advancing, and this gives some basis for the belief that machinery and machine tool orders will be more numerous next year. Inquiries are being received for replacement equipment. A few sales have been made, and others are expected. The general complaint of the dealers is that competition is forcing them to pay a prohibitive allowance for old equipment.

MILWAUKEE

Conditions in the machine tool market are maintaining the slight improvement noted in November. This has resulted in improved sentiment and returning confidence. Although a large demand is not expected for some time, moderate improvement is anticipated during the first quarter. Inquiries are showing a healthier trend. Industrial conditions also show signs of improvement. Allis-Chalmers reports a million-dollar order for transformers and switch gear equipment from the Pennsylvania railway for electrification projects. Nearly a thousand employees of the Milwaukee Road will be recalled to work Dec. 21 in the car and locomotive departments of the Milwaukee shops. The Four-Wheel Drive Auto Co., Clintonville, Wis., reports the biggest commercial backlog in its history with current orders requiring 700 employees, against all previous high records of 750. Harnischfeger Corp. has received another large order for machines to be used in Greece on reclamation and irrigation projects. The general picture is improving. Although the old inventory excuse for not buying will soon be dusted off for use on salesmen, aggressive selling efforts are expected to continue bringing a satisfactory amount of business.

WEEK . BY . WEEK

BUSINESS BAROMETER

Trends in General Business throughout the world

THEODORE H. PRICE
Editor, Commerce and Finance, New York

American business men profess to fear the assembling of a newly elected Congress. This fear is, however, a tradition and an affectation, as the havoc so often predicted generally proves to be an illusion that disappears when the national legislature really gets down to work. In this respect at least President Hoover's message conformed to precedent. He touched upon a great many subjects, but none of his recommendations has as yet been accepted by either political party, and a long debate over some of his proposals seems inevitable.

The Interstate Commerce Commission has authorized an advance of about 10 per cent in railway freight rates, provided the increased revenue is used to help the weaker railroads. It is, however, doubtful whether the advance in rates will materially help the railways unless the Brotherhoods agree to a moderate reduction in wages.

These developments indicate some improvement in the situation, but it has been adversely affected by cables from Germany, where the Government still seems to be struggling with the problem created by the short-term loans which will become automatically due when the moratorium has expired.

Turning again to Washington it is interesting to note that more than five thousand bills were introduced when Congress convened. The probability is that most of these measures will die aborning. Each one of them represents more or less work and effort on the part of its proponents and backers. Therefore, it seems improbable that we will get any affirmative legislation of importance much before New Year's, if indeed Congress can do more than organize itself before its members go home again for the holidays.

Comparative Quietude

Hence it is not surprising that the week should have been one of comparative quietude. Many proposals have been made and discussed. but action upon them in the near future seems unlikely. The course followed by the Canadian railway employees in accepting a 10 per cent reduction in wages had a sobering effect upon the American labor unions, whose members are coming to realize that there is a necessary relationship between wages and the cost of living, and that a reduction in pay need not be a hardship if there is a corresponding reduction in the price of essentials. Hence it is hoped that the employees of the American railways will speedily recognize that it is to their interest that the cost of operation should be brought within the available revenue as promptly as possible.

If this can be achieved there ought to be a distinct improvement in the financial status of the American railways and an increase in traffic.

The news from abroad is conflicting and difficult to interpret. The Hitler vote polled in Germany on Sunday, December 6, was surprisingly large. It is difficult for an American to interpret it intelligently, but it is plain that Germany is abundantly able to govern itself, and in the United States it is generally believed that as a democracy she will be successful. Of course, there are going to be moments of trouble or uneasiness, but at the "birth of a nation" such periods are inevitable, and the present disposition is to meet unavoidable developments philosophically.

Business Gains

In America there are many important industrial establishments that now admit a substantial gain in business. There are others in which there is less improvement, but there is an unmistakable rise in the tide of cheerfulness, and by Christmas it may be well above the low water mark.

The result ought to be a better feeling all the way round, and an improvement in feeling may be speedily followed by an improvement in fact. There are many items in the week's news that might be quoted to sustain this syllogism, but it is unnecessary.

In so far as the United States is concerned the most striking feature of the situation is the range of commodity prices, some of which are slightly lower than they were a week ago. An advance of nearly a cent an ounce in the price of silver, is, however, one of the exceptions. Another is the coffee market, which was temporarily shocked by the announcement that the Brazilian Government would destroy twelve million bags of the surplus supply of coffee, and raise the export duty on coffee from ten to fifteen shillings a bag. In the coffee trade it is expected that this program may be followed, but it is possible that the bankers who voted the last coffee loan may effectively protest against throwing their collateral away. Silk has touched new low levels, with futures selling below $2 per pound.

The other commodities, including cotton and grain, as well as rubber, have shown only moderate change, but they respond more readily to stimulating than to depressing influences.

On the New York Stock Exchange prices have receded, but the resistance against selling pressure is increasing and the possibility of an inflationary outburst is being more widely recognized day by day.

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THE BUSINESS WEEK

December 16, 1931

Most disturbing detail of a dismal week is the indifferent, almost stupid, response to the fundamental, hopeful and necessary measures of reconstruction suggested in the President's message. . . . This indicates the degree of demoralization of public opinion produced by the persistent decline of business activity, renewed weakness in commodity prices and establishment of new low levels in security markets as December sets in. . . . Continued delay in automotive demand, and price uncertainties, are letting steel activity down into the usual year-end slump, and most indicators except power production appear to be making up for the unseasonal bulge in October by more rapid seasonal recession during December. . . . In the case of currency outstanding this is still an encouraging symptom of strengthening in the bank situation, but may soon begin to reflect some retardation of holiday retail trade. . . . The European picture, particularly in Germany, begins to take on the crazy appearance of the Cabinet of Dr. Caligari, in which it becomes impossible to distinguish the sane from the insane. . . . Americans may well ponder the immense implications of the neurotic nationalism that is emerging in Europe in bitter tariff wars, and the forced reduction of interest rates by edict in Germany. . . . Our security markets are undoubtedly being unreasonably infected by the imbecilities abroad, since not even the immediately depressed condition of domestic business, disappointing dividend action, or delay in dealing with railroad dilemmas can account for the absurdities of current quotations, in face of the unquestionable potentialities and promise of independent improvement in the domestic picture implicit in the President's program.

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Material Trends and Prices . . . .

With volume of demand for automotive steel only partly up to expectations, attention is directed to a slight stir of activity in buying of tank plates and agricultural-machinery material. Public works are taking heavy tonnages of structurals at New York, but with scrap prices down to record low levels, the market as a whole rests on a weak foundation. The unfilled tonnage report, issued Dec. 10, showed lighter back-logs than at any time since 1910. Demand for copper and zinc has shown definite improvement in the last week, while that for lead remains steady. The tin market continues dull.

(All prices as of Dec. 11, 1931)

IRON AND STEEL

Pig Iron —	Current	Mo. Ago	Yr. Ago
Birmingham, No. 2, Fdry., per gross ton	$11.00	$11@$12	$14.00
Buffalo, No. 2, Fdry., per gross ton	15.00	17.00	15.25
Heavy Melting Steel Scrap — Pittsburgh consuming point, No. 1, per gross ton	10.00	10.00	12.75
Furnace Coke — Connellsville, per net ton	2.35	2.40	2.40
Foundry Coke — Connellsville, per net ton	3.25	3.25	3.50
Steel Shapes — Pittsburgh, base, per 100 lb	1.50@1.60	1.60	1.60

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Iron Machinery Castings — Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight, 275 lb.:

Chicago....4.62½ Cleveland....4.50 New York....4.75
Cincinnati....4.35 Detroit....4.00

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Steel Sheets — Prices in cents per lb., del. from warehouse stock (except at Pittsburgh) in lots of 401 to 999 lb., ordered and released for shipment at one time:

	Pitts. Mill	Chicago	Cleveland	New York
Blue annealed, No. 10	1.85	3.20	3.00	3.40
Black sheets, No. 24	2.40	3.55	3.60	3.50
Galvanized, No. 24	2.90	4.10	4.00	4.00

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Seamless Steel Tubing — Cold-drawn mechanical tubing, round, .10 to .30 carbon, in lots of less than 100 ft. or 100 lb., net, at N. Y. warehouse:

Thickness of Wall		Outside Dia. in Inches						
		¼	⅜	½	¾	1	1¼	1½
Inches	B.w.g.	Price per Foot						
.035	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23

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Shapes, Plates, Bars, Etc. — Warehouse base prices in cents per lb., del. in lots of 401 to 999 lb., ordered and released for shipment at one time:

	New York	Cleveland	Chicago
Bands	3.40	3.00	2.95
Bars, soft steel	3.10	2.75	2.75
Cold fin., flat or square	3.90	3.60	3.60
Cold fin., round or hexagon	3.40	3.10	3.10
Cold rolled strips	4.95	6.00	5.50
Floor plates	4.85	5.00	5.00
Hoops	3.75	3.65	3.50
Rivets	4.00	4.00	4.00
Shapes	3.10	2.95	3.00
Spring steel	4.00	4.00	4.00
Tank plates	3.10	2.95	3.00

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Stainless Steel — Hot-rolled bars, base, Pittsburgh. 0.12 per cent carbon, cents per lb.:

Chromium 15% and under....19.00 Chromium 18 to 23%....23.00
Chromium 15 to 18%....20.50 Chromium 23 to 30%....28.00

Bolts and Nuts—Discount from list, f.o.b. mills, Birmingham, Chicago, Cleveland and Pittsburgh, on bolts (except tire and stove), nuts, and lag screws, mill lots....73–10–10%

NON-FERROUS METALS

Prices following are in cents per lb. for mill shipments in carlots:	
Aluminum ingots 99%, N. Y	23.30
Copper, electrolytic, Conn	6.50
Copper wire, base, Chicago and Cleveland	8.87½
Copper wire, base, N. Y	8.75
Lead, pigs, E. St. Louis	3.65
Tin, Straits, pigs, spot, N. Y	20.50
Zinc, slabs, E. St. Louis	3.17½
Prices following are in cents per lb., base, N Y., Chi. and Cleve.:	
Brass rods, high	10.62½
Brass sheets, high	12.87½
Brass tubing, high	16.12½
Copper, drawn round	13.37½
Copper sheets	15.87½
Copper tubing	15.37½
Prices following are in cents per lb., del. from N. Y. warehouse:	
Babbitt, anti-friction, general service	28.50
Babbitt, com'l, intermediate grade	34.25
Babbitt, genuine, highest grade	43.00
Solder, bar	16.87½
Prices following are in cents per lb., base, Huntington, W. Va.:	
Monel metal rods, hot rolled	35.00
Monel metal sheets, full finished	42.00
Monel metal tubing, seamless	65.00
Nickel rods, hot rolled	45.00
Nickel sheets, full finished	52.00
Nickel tubing, seamless	75.00

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Scrap Non-Ferrous Metals — Dealers' purchasing prices in cents per lb., f.o.b. cars:

	New York	Cleveland	Chicago
Heavy yellow brass	2.25	2.00	2.50
Light brass	1.75	1.25	2.00
No. 1 rod-brass turnings	2.75	2.25	2.25
Heavy copper	4.75	3.75	3.75
Light copper	3.75	3.25	3.50

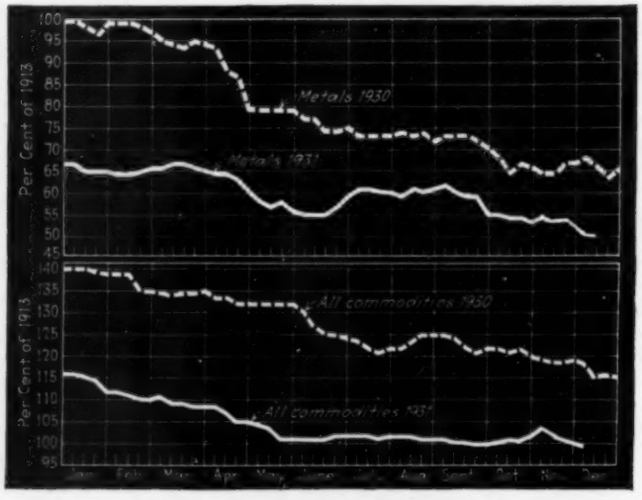
SHOP SUPPLIES

(Prices at warehouse)	New York	Cleveland	Chicago
Abrasive disks, aluminum oxide No. 50 grain, cloth, 6-in. dia., X weight, per 100	$4.37	$4.59	$4.59
Belting, leather, heavy	30–10%	40%	40%
Belting, rubber, trans., Grade 1	60–10–10%	60–10%	60%

Lumber — Per M ft., b.m., 12-16 ft. lengths, delivered, N. Y.:

Crating — Southern pine:
1x4-in.... $27.00 1x6-in.... $26.00

Skids—Spruce:
2x4-in...$37.00 3x4-in..$40.00 4x6-in..$42.00 6x6-in ..$50.00



Price Movements Week by Week

Average Price of Raw Metals: Pig Iron, Billet Steel, Copper, Tin, Lead, Zinc—American Machinist
Seventy-Four Commodities Index—The Annalist

NEWS

Charles L. Allen Honored at Dinner

A dinner in honor of CHARLES L. ALLEN, president and general manager of the Norton Co., commemorating the completion of fifty years of leadership in the company, was given at the Worcester club, Dec. 4. Mr. Allen has been general manager during all of the 45 years that have elapsed since the organization in 1885 of the Norton Emery Wheel Co., as the Norton Co. was first known. When Mr. Allen entered the business the grinding wheel was unknown as a manufacturing tool. F. B. NORTON conducted a pottery in an old building in Worcester and there, in 1873, the first emery wheel was made by a vitrifying process. Wheels were first manufactured commercially at the pottery in 1879. Mr. Allen joined the business in 1881. He was one of the group of men who conceived the idea that the abrasive wheel was destined to be an important factor in manufacturing. The others were MILTON P. HIGGINS and GEORGE I. ALDEN, professors at the Worcester Polytechnic Institute; JOHN JEPPSON, expert in ceramics, and W. L. MESSER. The outcome of their theory was the formation of the Norton Emery Wheel Co., incorporated in 1885.

The dinner was made the more significant by international recognition. President Hoover sent a telegram of congratulation and former president Calvin Coolidge also sent a letter to his friend. King Gustaf V of Sweden, through Olof H. Lamm of New York, consul general for Sweden to the United States, made Mr. Allen a knight of the first class of the Order of Vasa, in recognition of his great contribution to the development of friendly relationship between the U. S. and Sweden. This honor has been conferred upon very few American citizens not of Swedish descent. Mr. Allen was presented with a solid silver trophy in commemoration of the occasion. Eighty officials of the company, including the managers of branch offices in many cities, were present. ALDUS C. HIGGINS, treasurer, was toastmaster.

Federal Specifications

A proposed revision of Federal Specification No. 290a, for Bronze Ingots, has been submitted under No. QQ-B-701. QQ-C-521 on Copper Ingots has been submitted to industry as a proposed revision of No. 120, QQ-N-301 on Nickel for Remelt Zinc as a revision of No. 371. QQ-T-371 on Pig Tin as a revision of No. 90, QQ-C-581 on Silicon Copper as a revision of No. 119, and QQ-C-571 on Phosphor Copper as a revision of No. 118.

A.M.A. Divisions Change Names

It has been decided to change the existing Production division of the American Management Association to a Job Order Production division, with O. D. REICH, vice-president and works manager of the Dexter Folder Co., as vice-president in charge. The existing Shop Methods division has been changed to Mass Production division with P. L. DILDINE, manager of factory standards, B. F. Goodrich Co., as vice-president in charge. The program on Production Planning and Control scheduled for the existing Shop Methods division will be held by the Mass Production division in Dayton, Jan. 19 and 20. The meeting planned for Chicago in March will be held by the Job Order Production division, the subject being "Long Range Production Planning." The name change decision was based on the conviction that interest in the activities of the A.M.A. in these production fields divides more naturally on the basis of the character of the production situation rather than upon the character of the problem.

World Prices Grow Steadier

Likelihood that the United States may be the first nation to recover from the present world depression is seen by the National Foreign Trade Council in the fact that our domestic price levels for the first time in almost two years have acquired a comparative stability. In issuing its annual report on international trade the Council points out that wholesale prices in the United States have remained for five months within about 2 per cent of the index for last June, in contrast with the drop of 11 per cent in the first six months of this year, and in further contrast with the accumulated reduction in average wholesale prices in the United States of more than 25 per cent for the past two years. World export prices, however, as distinguished from the domestic wholesale prices, have dropped this year a little more sharply than they did last year, the ruling prices for the chief articles entering into international trade being 15 per cent lower for the first nine months of this year than for the corresponding period of 1930, compared with a drop of about 12 per cent between 1929 and 1930. World export trade for 1931, based on figures up to Nov. 1 for nations carrying on about three-quarters of the world's commerce, will be a little less than $20,000,000,000, as adjusted to a common standard of value based on export prices in 1913. This is about 16 per cent less trade in real value than was carried on last year. The recession in export trade between 1929 and 1930 amounted to about 9 per cent. A favorable factor is, however, that the severest recession in most cases took place early in the year.

The outstanding feature of 1931 has been the continued relative recovery of Germany. This year for the first time German exports exceed those of Great Britain. The margin for the first six months is by about 1½ per cent, and so far as a comparison of later months is possible this margin is slightly increasing, establishing Germany as second only to the United States as the world's largest exporter. The relative position of the United States has been impaired during both of these years of recession. During 1930 our exports fell off in real value by about 18 per cent, while the recession for the world as a whole was about 9 per cent. During the first six months of 1931 our exports fell off 22 per cent, compared with the average recession of 27 nations carrying on 75 per cent of the world's trade of 16 per cent. Our share of the world's exports for the first half of 1931 is still substantially greater, however, than 12.3 per cent we had in 1913.

Measurement Units Institute Elects

At the annual meeting of the American Institute of Weights & Measures in New York recently, DR. W. R. INGALLS, consulting mining engineer, was re-elected president and WM. E. BULLOCK, secretary. LUTHER D. BURLINGAME, patent expert, Brown & Sharpe Mfg. Co., presented an exhaustive paper on the history and status of the inch from the viewpoint of its value determined for comparisons of high precision standards. The secretary's report summarized current relations of the Institute to scientific and technical bodies, particularly in Great Britain, Canada and this country. DR. G. M. WILSON, professor of education, Boston University, described a year's study on the use of measurement units and standards in industries in this country and abroad. Announcement was made of a projected meeting of the Institute at Washington next May in connection with several projects of the Bureau of Standards in the field of measurement standards in industry.

6,772 Engines Need Repair

Class I railroads in the United States on Nov. 15 had 6,772 locomotives in need of repairs, or 12.6 per cent of the number on line. This was an increase of 287 locomotives above the number in need of such repairs Nov. 1.

Materials Handlers Form Institute

Representatives of 62 companies engaged in the manufacture of materials handling equipment met last week at the Hollenden Hotel, Cleveland, and established the Materials Handling Institute. These officers were elected: president, FRANK E. MOORE, president, Mathews Conveyor Co., Ellwood City, Pa.; vice-president, J. B. WEBB, president, J. B. Webb Co., Detroit; treasurer, H. W. STANDART, Northern Engineering Works, Detroit, and secretary, JOHN A. CRONIN, editor, *Materials Handling and Distribution*, New York.

Dr. E. W. Rice to Get 1931 Edison Medal

The 1931 Edison Medal has been awarded to DR. EDWIN WILBUR RICE, JR., honorary chairman of the board of the General Electric Co., Schenectady, "for his contributions to the development of electrical systems and apparatus and his encouragement of scientific research in industry," it has been announced by F. L. HUTCHINSON, national secretary of the American Institute of Electrical Engineers. The Edison Medal was instituted by friends and associates of Thomas A. Edison and is given annually for "meritorious achievement in electrical science, electrical engineering, or the electrical arts." The award is made by a committee of twenty-four members of the Institute. It will be presented to Dr. Rice at the Intitute's convention, Jan. 25 to Jan. 29.

BUSINESS ITEMS

Eighteen special riveting machines with auxiliary equipment, manufactured by the Cleveland (Ohio) Pneumatic Tool Co., will be sent to the Soviet automobile plant at Nizhni Novgorod.

Prediction that the Greenwood (Ind.) plant of Noblitt-Sparks Industries, maker of steel tubing for bicycles and other items, will be in full operation by the first of the year, is made by Superintendent McWorkman, as a result of the general increase being experienced now.

The Vulcan Engineering Works, Ltd., Granville Island, Vancouver, B. C., is constructing a 175-hp. motor-driven shaft hoist for the Northern Construction Co., Ltd., to be used in construction of a pressure tunnel under the Lions Gate for the Greater Vancouver Water District. The hoist will weigh 12½ tons and is capable of handling six tons at 400 ft. per min.

The Trojan Co., Erie, Pa., has been merged with the Welding & Motor Parts Co., also of Erie. The two plants will be consolidated in the Welding company's works. The first company manufactures washing machines, the second operates a large general machine business.

The Desmond-Stephan Mfg. Co., Urbana, Ohio, has succeeded the Simplex Corp., Woonsocket, R. I., in the manufacture and sale of the complete line of Simplex machinists and utility vises. The Simplex line of steel slide vises will be manufactured in Urbana, Ohio, and has been added to the Desmond line of grinding wheel dressers and cutters.

The American Machine & Metals, Inc., New York, is negotiating for acquisition of the Tolhurst Machine Works, a division of General Laundry Machine. Tolhurst has a factory in Troy, N. Y., and manufactures laundry machinery, centrifugals and other equipment.

Several shops are to be included in the Patterson Park Junior High School to be constructed in Baltimore next year. Plans have been approved by the Public Improvement Commission. The building will include machine, sheet metal, electrical, wood and automobile shops, a general shop and three mechanical drawing rooms.

The Malleable Iron Fittings Co., Branford, Conn., has taken advantage of dull times to add new products, chief among which is a new oil burner. The company has also made improvements to its pole mounts for telephone and electric light poles.

The Automatic Screw Machine Products Co., Chicago, Ill., has been licensed by the Dardelet Threadlock Corp., 120 Broadway, New York, N. Y., to manufacture nuts and screw machine products threaded with the Dardelet self-locking screw thread.

The Buerk Tool Works, Buffalo, N. Y., manufacturer of tools, dies and special equipment, is moving from its Pearl Street factory to a larger plant at 315 Grote St., early in January.

The Fuerst-Friedman Co., 1292 East Fifty-third St., Cleveland, Ohio, has changed its name to the Electric Generator & Motor Co. No other change was made. The company sells, rebuilds, repairs and rents electrical machinery and equipment.

The Pacific Brass Foundry, 528 Folsom St., San Francisco, Calif., manufacturer of brass, bronze and aluminum castings, is also now casting Everdur and Shaw metal.

Barnet Bros., 82 Geary St., Buffalo, N. Y., heating and ventilating engineers, have moved into a new large plant at 1282 Abbott Rd.

Standard Stoker Co., Erie, Pa., has begun construction of a new office building and tool storage warehouse.

The Federal Tool & Die Co., 227 Iron St., Detroit, Mich., is liquidating all machinery and tools. International Machinery will handle the sale.

Tools of the Standard Tube & Mfg. Co., 2435 Scotten Ave., Detroit, Mich., have been sold.

PERSONALS

JAMES A. BELL, 70, an employee of the Illinois Steel Co., Joliet, Ill., for the past 43 years, and for the past 21 years general master mechanic, has been retired on pension. He has been succeeded by GEORGE T. JONES, who has been assistant master mechanic.

H. BORNSTEIN, of Deere & Co., Moline, Ill., will be the guest speaker at the Dec. 21 meeting of the Quad-City Foundrymen's Association in Rock Island, Ill.

K. H. CONDIT, publishing director and editor, *American Machinist* and *Product Engineering*, has been appointed one of the representatives of the American Society of Mechanical Engineers on the American Standards Council.

L. E. GILMORE, of the Crane Co., Chicago, has been re-elected president of the Chicago Foundrymen's Club. Other officers also re-elected include R. E. KENNEDY, vice-president of the A.F.A., Chicago, as vice-president, and ALBERT N. WALIN, S. Obermayer Co., Chicago, as secretary-treasurer.

JAMES H. HABERLY, vice-president of the Fort Wayne (Ind.) Engineering & Mfg. Co., has returned to his home following a serious operation at the Mayo clinic. He will convalesce for several weeks before returning to his office.

FREDERIC E. WILLIAMSON has been elected president of the New York Central Railroad, and RAYMOND D. STARBUCK, now vice-president of operation, has been promoted to executive vice-president. The office of chairman of the executive committee has been abolished, leaving Mr. Williamson and Mr. Starbuck at the head of the system. Mr. Williamson, who will resign as president of the Chicago, Burlington & Quincy Railroad Jan. 1, was elected a director of the New York Central and a member of the executive committee. He succeeds PATRICK E. CROWLEY in the New York Central presidency.

THOMAS R. JONES, vice-president and general manager of the Harris-Seybold-Potter Co., and vice-president in charge of the Production Division of the A.M.A., spoke on "Managerial Control of Labor and Material" at a joint meeting of the New York chapter, National Association of Cost Accountants, and the New York Group of the American Management Association, Dec. 15.

H. P. PEABODY will act as chairman of a meeting of the Boston section, A.W.S., on Dec. 18, on the subject of "High-Speed Oxy-Acetylene Welding."

Robert H. Morse

Now president and general manager Fairbanks Morse & Co., as announced last week in *AM*

John Howe Hall, of the Taylor Wharton Co., spoke on "Production, Heat-Treatment and Application of Cast Alloy Steels of the Alloyed Manganese and Stainless Steel Types" before the December meeting of the New York Chapter, A.S.S.T., on Dec. 14.

J. M. Kerr, formerly sales manager of the Potter Mfg. Co., and president of Willeray Confections, Inc., Jackson, Mich., has joined the metal-stamping division sales department of the Kelsey-Hayes Wheel Co., Detroit.

Anthony H. Kramer, president of the Advance Foundry Co., Dayton, Ohio, has been re-elected president of the Ohio Foundries Association.

H. M. Mystrom has returned to the open-hearth department of the Falk Corp., Milwaukee, after a four months' leave of absence.

Rufus L. Patterson, president of the American Machine & Foundry Co., New York, is the co-donor with John M. Moorehead, American Minister to Sweden, of a bell tower valued at $100,000 recently presented to the University of North Carolina, Chapel Hill.

Vaughn Reid, of the City Pattern Works, Detroit, spoke on "Patterns" before the regular meeting of the Quad-City Foundrymen's Association recently in Moline, Ill.

Earl C. Snell, personnel director of the Griswold Mfg. Co., Erie, Pa., has been elected secretary. Charles A. Massing has been appointed sales manager.

F. L. Walker, Erie Foundry Co.; A. E. Koch, Odin Stove Mfg. Co.; A. J. Woodbridge, Skinner Engine Co.; W. C. Culbertson, Erie Malleable Iron Co.; A. J. Becker, Bucyrus-Erie Co.; M. M. Wallace, Erie City Iron Works; C. E. Portiner, Griswold Mfg. Co., and John W. Cooke, Standard Stoker Co., are leading in the organization of metal-working purchasing agents in Erie, Pa.

Stacey H. Widdecombe has been appointed sales manager for the Robinson Iron & Steel Co., fabricator of Mayayunk, a suburb of Philadelphia. He was formerly Philadelphia district sales manager for the Shoemaker Bridge Co.

OBITUARIES

William W. Blackburn, 72, for 26 years vice-president and secretary of the Carnegie Steel Co., Pittsburgh, who retired in 1927, died Dec. 10 after a prolonged illness. He joined Carnegie in 1880.

W. W. Cheney, Jr., 44, vice-president and superintendent of S. Cheney & Son, Manlius, N. Y., died Nov. 28 of pneumonia.

Robert I. Clegg, 65, formerly associate editor of the *Iron Trade Review*, *The Foundry*, and *The Iron Age*, died Dec. 3 at his home in Cleveland. At the time of his death he was vice-president of the Gardner Printing Co., Cleveland, and the Masonic History Co., Chicago. One of his two surviving sons, Lee M. Clegg, is vice-president of the Thompson Products Co., Cleveland.

William J. Erdle, president and treasurer of the Erdle Perforating Co., Rochester, N. Y., died Dec. 6 at his home there, following a month's illness.

Donald Fraser, 78, director and former vice-president of the Chain Belt Co., Milwaukee, Wis., died recently. Mr. Fraser, formerly engaged in the pattern-making business in Minneapolis and Milwaukee, came to the Chain Belt Co. in 1895. He was very active in the early development of the company, contributing many important inventions to the chain business. He subsequently became vice-president and works manager, retired in 1917, and was made a director. He was also a director of the Sivyer Steel Casting Co. and the Federal Malleable Co., both of Milwaukee.

C. W. Hoffman, 79, retired elevator manufacturer, died Dec. 10 of heart disease after an illness of five weeks. He was president of Charles W. Hoffman & Co., New York City, until he retired in 1912.

Robert C. Hupp, 55, pioneer automotive manufacturer, died suddenly Dec. 6 of a cerebral hemorrhage. He first worked for the Olds Motor Works as a mechanic. Later he joined the Ford Motor Co., resigning in 1908 to build his own automobile. At one time or another he built the Hupmobile, the R. C. H. and the Monarch cars. He retired from automobile manufacturing in 1916 to turn his attention to other phases of the industry.

John A. Lefferts, 65, retired industrial engineer, died recently as a result of a cerebral homorrhage. He had retired from business a year ago on account of ill health. Mr. Lefferts was for many years associated with the J. L. Mott Iron Works, New York, and went to Chicago three years ago as industrial engineer for the Wolff Mfg. Co.

Frank Moore, 72, well-known railroad equipment engineer long associated with the Westinghouse Air Brake Co., Pittsburgh, Pa., died Dec. 6 at his home there. He organized and for many years was president of the Pittsburgh Malleable Iron Co., the Zanesville Malleable Iron Co., and at the time of his death was president of the Pittsburgh Machine Tool Co., and consulting engineer for the Westinghouse Air Brake Co.

Henry A. Pridmore, 49, identified with his father who founded the Henry E. Pridmore Co., molding machines and foundry supplies, died recently in Oak Park, Ill. He had been identified with the foundry supply industry for 30 years, and had been connected with his father's company until the firm discontinued business in 1927. Since then he had been with the International Harvester Co., Chicago.

Howard Rankin Sargent, 60, a native of Newton, Mass., engineer of the merchandise department of the General Electric Co., Bridgeport, Conn., died unexpectedly Dec. 8 at his home in Bridgeport after an operation for appendicitis. He was credited with many important developments and inventions, and had been connected with the General Electric since 1892.

Oliver Cromwell Smith, 73, president of the Smith & Egge Mfg. Co., Bridgeport, Conn., died suddenly Dec. 7.

Leon Thomas, 53, past president of the Association Technique de Fonderie de Paris and consulting engineer on foundry practice, died recently.

Percy W. Turner, 55, assistant treasurer of the Eastman Kodak Co., Rochester, N. Y., died recently at the Buffalo General hospital after a short illness.

Joseph White, 81, pioneer brass foundry operator of Lima, Ohio, died recently.

MEETINGS

National Automobile Show
New York, Grand Central Palace, Jan. 9-16; Chicago, Coliseum, Jan. 30-Feb. 6.

Steel Founder's Society of America, Inc.
Annual meeting, Chicago, Ill., Jan. 21, 1932. G. P. Rogers, managing director, 932 Graybar Bldg., New York City.

National Association of Engine & Boat Manufacturers
Motorboat and marine engine show, Grand Central Palace, New York City, Jan. 22-30, 1932. Henry R. Sutphen, president.

Society of Automotive Engineers
Annual meeting, Book-Cadillac Hotel, Detroit, Mich., Jan. 25-29. John A. C. Warner, secretary, 29 West 39th St., New York, N. Y.

American Institute of Electrical Engineers
Annual Winter meeting, Engineering Societies Bldg., New York, N. Y., Jan. 25-29. F. L. Hutchinson, secretary, 33 West 39th St., New York City.

Second International Heating & Ventilating Exposition
Sponsored by American Society of Heating & Ventilating Engineers, in Grand Central Palace, New York City, Jan. 25-29. Charles F. Roth, manager, Grand Central Palace, New York, N. Y.

American Management Association
Packaging, packing and shipping exposition Palmer House, Chicago, Ill., Mar. 7-12, 1932. W. J. Donald, managing director, Room 602, 225 West 64th St., New York, N. Y.

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Opportunities for Future Business

Ariz., Payson — Golden Wonder Mining Co. Ltd., 7100 Sunset Blvd., Hollywood, Calif., plans construction of a 20 ton mill near here. Estimated cost $20,000.

Calif., Los Angeles—Loose-Wiles Biscuit Co., 811 Commerce St., Kansas City, Mo., plans construction of a 1 story, 140 x 220 ft. warehouse and garage at 600 Gage Ave. here. Estimated cost $40,000. Claud Beelman, 1019 Union Bank Bldg., Los Angeles, Archt.

Calif., Los Angeles—Safeway Stores, Inc., 1925 East Vernon Ave., awarded contract for a 1 story, 155 x 326 ft. warehouse at 1925 East Vernon Ave. Estimated cost $100,000.

Calif., Pasadena—City is having plans prepared for construction of a 1 story warehouse including machine and repair shop, storage building, etc., at 1103 Glenn Ave. Estimated cost $100,000. Marston & Maybury, 25 South Euclid Ave., Archts. Benjamin DeLanty, City Hall Engr.

Calif., San Francisco—Treasury Department, Office of J. A. Wetmore, Supervising Architect, Washington, D. C., will receive bids until January 8 for construction of a group of buildings including garage, etc. for U. S. Marine Hospital here.

Conn., Portland—Town, Walter Penfield, Chn. Bldg. Comm., awarded contract for construction of a 2 story, 60 x 125 ft. junior and senior high school including manual training departments. Estimated cost $150,000. Noted December 3.

Ia., Bellevue—Town is completing municipal light plant, basement of building, 40 ft. wide, 60 ft. long and 20 ft. high to contain waterworks equipment and machine shop. Estimated cost to exceed $60,000.

Ia., Cedar Rapids—Century Engineering Corp., 213 17th Ave. S. E., awarded contract for construction of a 1 story, 60 x 140 ft. factory.

Ia., Davenport—Frank's Foundry, 1739 West Second St., awarded contract for a 1 story, 50 x 91 ft. addition to foundry. Estimated cost $15,000.

Ia., Sioux City—Ben Fish, awarded contract for construction of a 1 story, 60 x 140 ft. garage. Estimated cost $30,000. Northwestern Bell Telephone Co., Sioux City, is lessee.

Ia., Waterloo—Waterloo Foundry Co., Andrew Fischels, Prop., 1049 Sheffield Ave., awarded contract for construction of a 1 story, 42 x 60 ft. foundry.

Md., Baltimore—Western Electric Co., Point Breeze, plans addition to rubber-covered wire shop. Additional machinery will be installed.

Mass., Amherst—H. B. Ketchen, 11 East Pleasant St., awarded contract for 1 story automobile service station on Pleasant St. Estimated cost $45,000. Noted December 3.

Mass., Boston—Skinner Organ Co., Boston and Aeolian Co., 5th Ave. and 54th St., New York, N. Y., plans alterations to piano manufacturing plant here. Estimated cost to exceed $40,000 including equipment. Work will be done by day labor and separate contracts.

Mass., Cambridge (Boston P. O.)—Boston Elevated Railway Co., Park Sq. Bldg., Boston, receiving bids for construction of a 1 story emergency station on Bennett St. here. Private plans.

Mass., Danvers—G. Stahler, 15 High St., Middletown, awarded contract for construction of a 1 story, 60 x 100 ft. garage and showroom on Maple St. here. Estimated cost $40,000. Noted November 5.

Mass., Northampton—Clark Institute for Deaf & Dumb, having preliminary plans prepared for construction of two shop buildings each 2 story, 40 x 80 ft. Estimated cost $70,000. Fechheimer & Ihorst, Provident Bank Bldg., Cincinnati, O., Archts.

Mass., Saugus—Owner c/o R. S. Roble and C. A. Allen, 6 Belvidere St., Boston, plans construction of a bulk oil plant at Saugus Marsh here, 30,000,000 gal. storage capacity. Estimated cost $1,000,000. Private plans.

Mass., Springfield—General Electric Co., E. A. Wagner, Gen. Mgr., Pittsfield, plans construction of a 2 story sales and service station on King St. here. Estimated cost $40,000. Private plans.

Mass., Waltham (Boston P. O.)—Woodward & Tyler, 844 Main St., preparing plans for construction of a 1 story service station at Main and Bank Sts. Estimated cost $50,000. Private plans.

Minnesota—Dept. of Purchase, Carl R. Erickson, Comr., State Capitol, St. Paul, will receive bids until December 22 for construction of highway patrol stations and garages at Brainerd and Owatonna, Minn.

Minn., Long Prairie—Wolter Bros. Transportation Co., awarded contract for rebuilding 1 story, 50 x 64 ft. garage recently destroyed by fire.

Minn., Minneapolis—City Water Department, W. B. Heath, Supervisor, will soon award contract for construction of a 2 story meter repair shop at Third St. S. between Second and Third Aves. Estimated cost $75,000. Noted November 26.

Minn., Minneapolis—O. O. Oyen Co., Inc., 1201 Fourth St. S., considering rebuilding cabinet making plant destroyed by fire.

Minn., St. Paul—Minnesota Fence & Wire Works, 240 University Ave., plans addition and alterations to plant. Max Buetow, 1380 Blair St., Archt.

Mo., Kansas City—Landon Airlines, T. G. Landon, Municipal Airport, awarded contract for a 1 story hangar, shop and office building. Estimated cost $40,000.

N. H., Milford — Souhegan Motor Co., c/o Arthur William Osberg, 795 Elm St., Manchester, Archt., revising plans for a 1 story, 72 x 110 ft. addition to garage. Estimated cost $40,000. Noted June 25.

N. J., Jersey City—Lafayette-Greenville Bus Owners Association, and Greenville Bus Co., 77 Seaview Ave., having preliminary plans prepared for a 1 story garage building and bus terminal at Gates Ave. and Merritt St. Estimated cost $150,000. Harry Adelman, 437 Broadway, Bayonne, Archt. Noted December 3.

N. J., Newark—Charles Jeffreys, 38 Liberty St., completed plans for a 1 story shop and office building on Liberty St. Estimated cost $40,000. Alfred Peter, 207 Market St., Archt.

N. J., Newark—Star Electric Motor Co., 140 Miller St., will soon award contract for construction of a 1 story, 160 x 220 ft. factory on Riveraide Ave. Estimated cost $40,000. J. DiStasio & Co., 136 Liberty St., New York, N. Y., Archts.

N. J., Ridgefield Park—Board of Education, preparing preliminary plans for construction of a 2 story addition to school including manual training rooms, etc., on Teaneck Road. Estimated cost $200,000. Hacker & Hacker, 201 Main St., Fort Lee, Archts.

N. J., Trenton—Firestone Tire & Rubber Co., 1278 South Main St., Akron, O., awarded contract for construction of a 1 story, 90 x 180 ft. service station at Willow and West Hanover Sts. here. Estimated cost $30,000.

N. Y., Brooklyn—Realty Associates, Inc., F. Fox, Pres., 162 Remsen St., having sketches made for alterations to service garage and gas station on Calm St. Estimated cost $100,000. B. Driesler, Jr., 153 Remsen St., Archt.

N. Y., New York—Boyerton Burial Casket Co., 39 West 60th St., having sketches made for construction of garage, etc., on Webster Ave. and 188th St. Estimated cost $85,000. Bruit & Brown, 342 Madison Ave., Archts.

O., Cleveland—Greyhound Management Co., O. S. Caesar, Pres., 1783 East 11th St., awarded contract for remodeling bus terminal at East Ninth St. and Superior Ave. Estimated cost $160,000. Noted October 15.

Pa., Glenshaw—Board of Education, Shaler Township, F. C. Kaussman, Pres., awarded contract for a 3 story, 88 x 228 ft. elementary and high school including general shop, etc. at Mount Royal Blvd. Estimated cost $200,000. Noted November 19.

R. I., Pawtucket—Frank Cook, Inc., 103 Exchange St., completed plans for construction of 1 story, 80 x 300 ft. sales and service station on North Main St. Estimated cost $50,000. A. Addeo, 117 Broadway, Providence, Archt. Noted March 5.

R. I., Providence—J. J. Finnigan, 134 Sharon St., awarded contract for a 1 story service garage at 140 West Park St. Estimated cost $40,000 to $50,000. Noted October 22.

Tex., Tahoka—Continental Chemical Co., P. J. McIntosh, Gen. Mgr., Thomas Bldg., Dallas, will award contract at once for construction of a group of buildings including evaporating building, pumping equipment, etc. here. Estimated cost $1,600,000. W. D. Alt, 301-D Thomas Bldg., Dallas, Archt. A. G. Shuttler, Chicago, Ill., Engr. Noted December 10.

Wis., Appleton—Badger Printing Co., Pacific and Morrison Sts., having plans prepared for 2 story, 92 x 160 ft. printing plant. Estimated cost $40,000. LeVee & Gmeirel, 601 West College Ave., Archts.

Man., Winnipeg—National Battery Co., 1728 Roblyn Ave., St. Paul, Minn., plans construction of a plant here. Estimated cost $100,000. George P. Gastner is Vice-President.

Equipment Wanted

D. C., Washington—Bureau of Supplies & Accounts, Navy Department, will receive bids until January 5 for one motor driven crank shaper and one motor driven shaper for Navy Yard, New York or San Francisco, Calif. Scheds. 7072 and 7074.

Pa., Philadelphia—Bureau of Supplies & Accounts, Navy Dept., Washington, D. C.—will receive bids until January 5 for one motor driven heavy duty shaper and one motor driven face grinding machine for Navy Yard here. Scheds. 7071 and 7075.

Wash., Puget Sound—Bureau of Supplies & Accounts, Navy Dept., Washington, D. C.—will receive bids until January 5 for three motor driven radial drilling machines and one motor driven heavy duty vertical milling machine for Navy Yard here. Scheds. 7070 and 7078.

Que., Bic—Ferdinand Plourde (sash and door manufacturer)—complete equipment for plant.

Que., L'Assumption—Langlois Limited—interested in prices for sash and door manufacuring equipment.

Ont., Vernon—Ferdinand Pilon—receiving bids for complete equipment for planing mill.